



THE LIVING MUSEUM

Anisha Jayadevan, Ishika Ramakrishna, Janhavi Rajan & Manini Bansal



Illustrated by Babakiki

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WELCOME TO THE AWE-INSPIRING AND SPELL-BINDING LIVING MUSEUM!

Here you will find gifted architects and masters of disguise, among other fascinating creatures, plants and trees.

The Living Museum is all around you in the city. It is alive, mysterious, full of drama, and always changing.

If it's your first time, remember to be patient and respectful. You're just about to discover a whole new world. If you're a regular, you probably already know that there is much to explore, learn, and gawk at in wonder!

Let's start with an introduction to me, your guide.



IN AND AROUND YOUR HOUSE





I am a hunter, more fearsome than any tiger! I jump high and far, and have near 360 degree vision, so there is little that escapes my attention. I stealthily stalk my prey (insects and other spiders), and when I am close enough, I crouch and spring on them, driving my sharp fangs into their body.

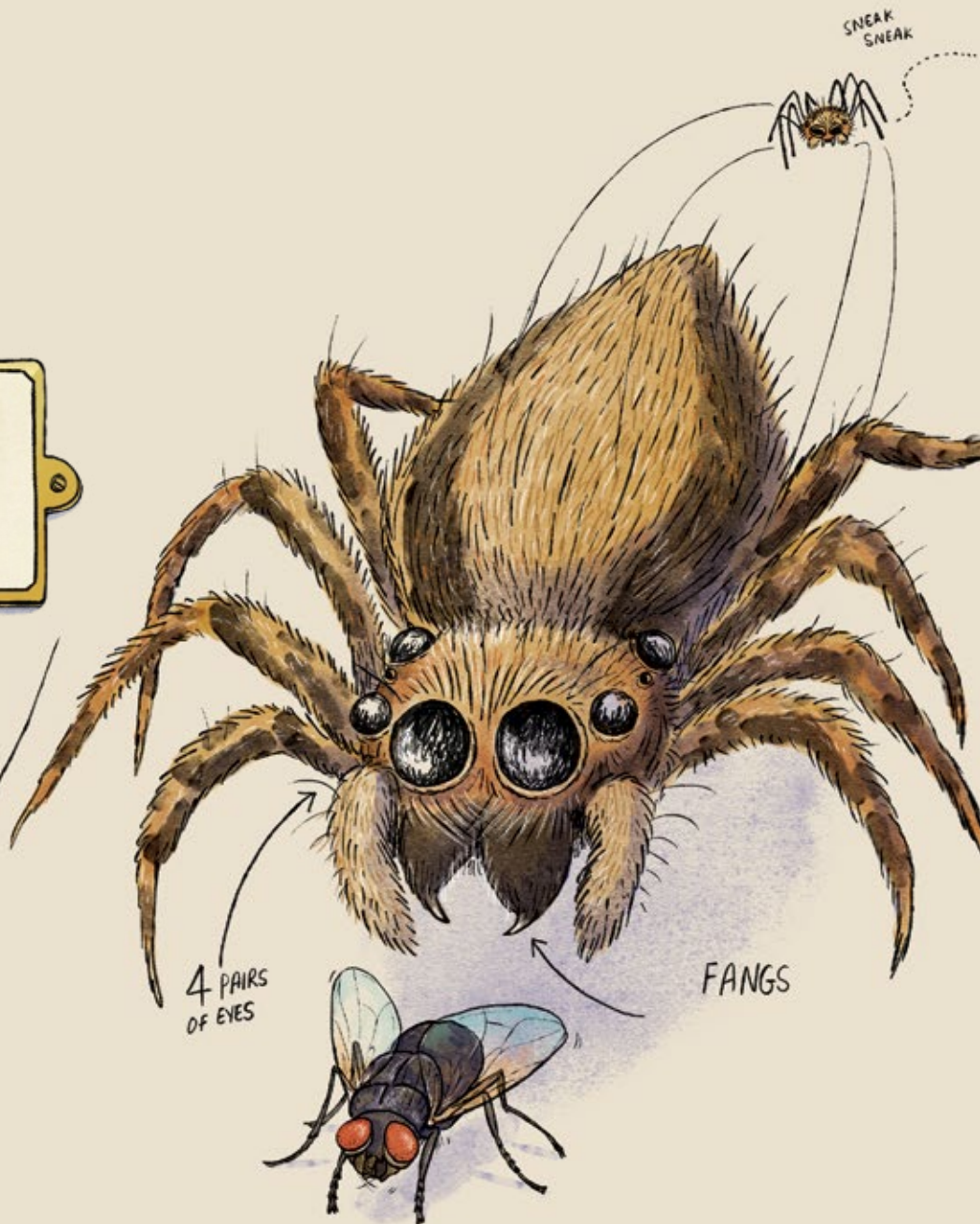
Unlike some other spiders you may have seen, I do not build a web to lie in wait for prey to get trapped in. Instead, I build webs only to rest in at night.

I see you are impressed, but fear not! Today, I am just your guide, I'll go about my hunting once we're done. Follow me, as I take you through The Living Museum. I hope you can keep up with my high jumps!



Jumping Spider

The Hunter



Bagworm

The Master Architect

That little speck of debris you see is the home of a skilled architect from the insect world: the bagworm.

The bagworm is not really a worm, but the caterpillar of a moth. The caterpillar builds its home by spinning a cocoon of silk around itself, and dressing it up with sand, leaves, pieces of twig or lichen. A clever way to trick its predators into mistaking it for dirt, don't you think?

The bagworm has other tricks too. The caterpillar can crawl around with its house like a hermit crab, but it can also fly! It does this by releasing a long strand of silk which acts like a parachute. With these 'wings', the caterpillar is carried by the wind and deposited away from where it hatched.

You could find these parachuting critters on walls, windows or doors!

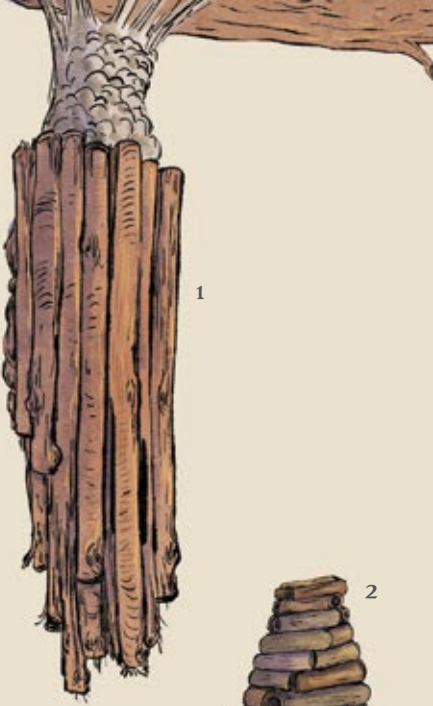
When bagworms develop into moths, males and females lead rather different lives. From the comfort of her home, the female attracts the male with perfume-like chemicals that she releases, called pheromones. Pheromones are used as a form of communication by many insects. Once the female has mated with a male, she lays eggs in her cocoon and dies. The hatched bagworm caterpillars then begin the wondrous cycle of parachuting away and constructing their mobile houses yet again.

KEY

1-4: There are nearly 40 species of bagworms in India, and each species has its own style of architecture

5: Bagworm moth caterpillar

6: Male bagworm moth





Neat cut-outs that you might see along the edges of leaves mean that a leaf-cutter bee has been at work. Like its name suggests, the leaf-cutter bee uses its mouth to cut leaves — and sometimes flowers — that it uses to build its nest. In fact, we could also deduce that the cuts were made by a female, as it is the female of this species that builds nests. If you are lucky, you will see her take away a piece of leaf or petal to a cavity in the soil, wall or door, to build her long, pipe-like nest.

The nest has multiple rooms, and each room has a little sack of pollen which the bee carries from the flowers she visits. She lays an egg in each pollen-filled room and seals it with a smaller leaf or some mud. When the bee larvae hatch, they will have some pollen to eat from the nutritious packed tiffin their mother left behind.

In the process of visiting flowers to collect pollen for their nests, bees pollinate flowers. We have them to thank for most of the vegetables and fruits we eat! Sadly, across the world, many bees are disappearing due to pollution and high use of pesticides in farms and gardens.

You can help support leaf-cutter bees by planting native flowering plants in your balcony or outdoor garden. It won't be long before you have a Living Museum exhibit as your neighbour or even housemate!





Leaf-cutter bees sting mildly only if you try to touch them. Don't be a nosy neighbour, keep your distance while observing them.

Leaf-cutter Bee

The Solitary Nestmaker



KEY

*1: Purple baubinia
2: The cuckoo wasp
lays its eggs in the
nests of other wasps
and bees*



Common Mormon
The Master of Deception

If you have a curry leaf plant, you won't be the only one who treasures its leaves. Butterflies and moths lay their eggs on specific 'host' plants for their caterpillars to feed on. They find their host plants by following chemicals released by the plant — like clues in a treasure hunt! Each plant has its own unique perfume, and on the trail of the curry leaf's perfume, is the common mormon, a butterfly.

The common mormon caterpillar and butterfly have many devious strategies to escape from their watchful predators. The caterpillar's scary or distasteful 'costumes' are one such strategy.

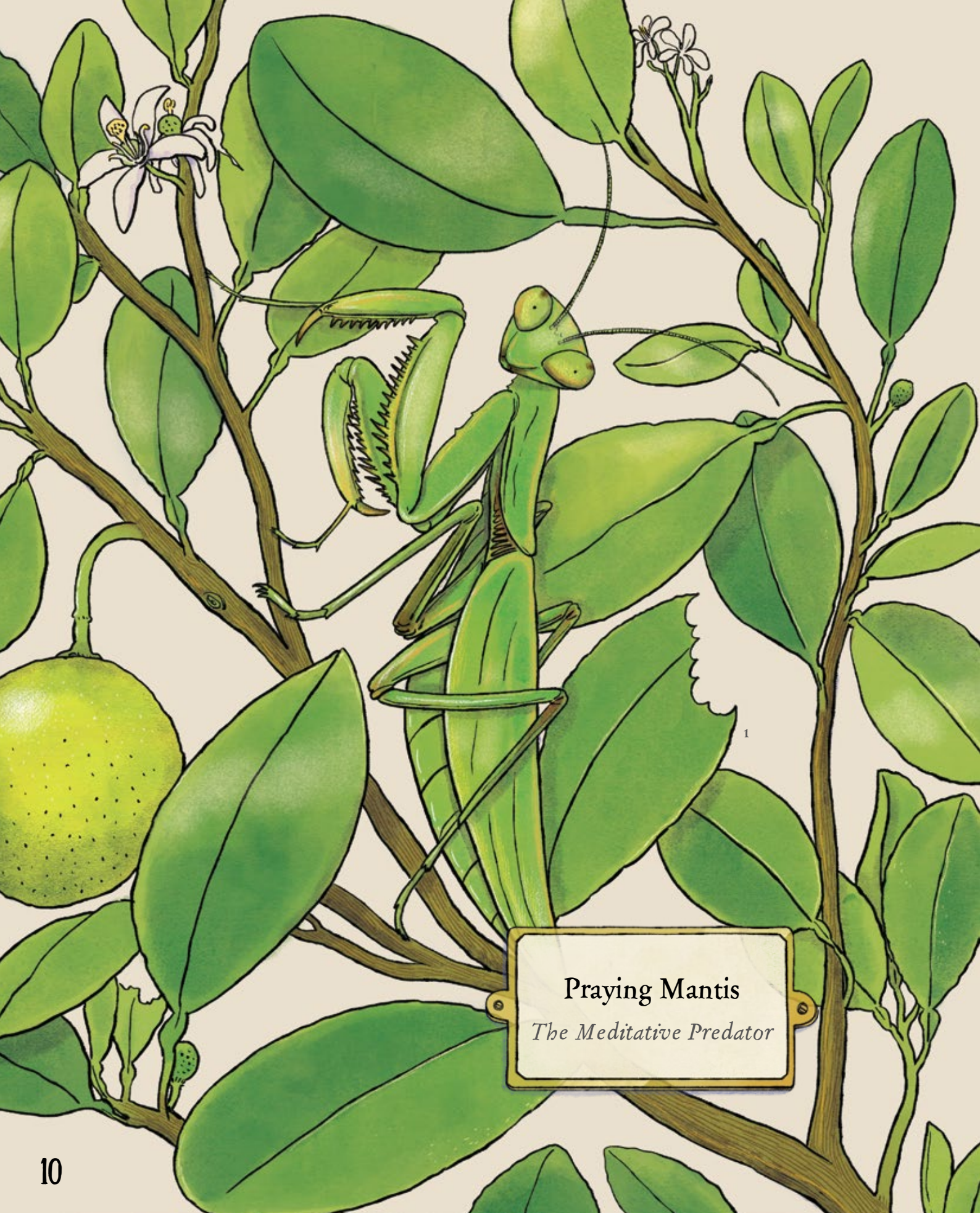
In its early stages, the caterpillar looks like bird droppings. As it grows, it develops big 'eye spots' that make it appear larger than it is. As if these costumes were not convincing enough, when it feels threatened, it sticks out a red organ that looks like a tongue, and emits a bad smell. The eye spots and tongue make the caterpillar look like a snake, and this, along with its bad smell, would make any predator think twice before eating it!

In its final growth phase, the caterpillar forms a pupa and undergoes metamorphosis, turning into a butterfly. Its days of tricking predators, though, are not over. For this last trick, the female butterfly escapes predation by resembling a distasteful species of butterfly called the swallowtail. Predators like birds learn to associate the appearances of their prey with its taste. So even though the common mormon does not taste bad, its close resemblance to the distasteful swallowtail is its shield of armour.



KEY

- 1-7: Stages of the common mormon life cycle
- 8: Female common mormon butterflies (L) mimic the distasteful swallowtail butterflies (R)
- 9: You can usually tell moths and butterflies apart from their antennae: butterflies (8) have matchstick-like antennae, while moths (9) have feather or thread-like antennae

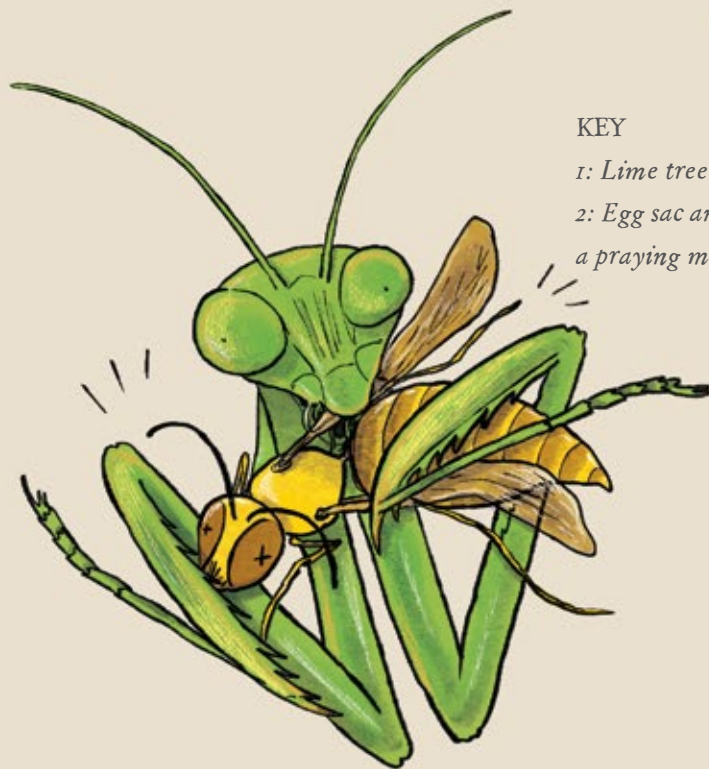


Praying Mantis
The Meditative Predator

Let's look closer at that little swaying twig. Does it have a triangular head with two arms folded together as though in deep thought or prayer? Well then, you're looking at a praying mantis! Rocking back and forth, this light green insect with large, bulging eyes may seem like it is staring right at you. This insect, one of over 2000 species of Mantids, is an expert at camouflage. Its long, slender body often looks like a fresh twig or a brand new leaf swaying in the wind. Some species of this insect are brown in colour, and found in leaf litter or soil, where they, too, blend into their surroundings.

The praying mantis has adaptations that make it a fearful predator. The head of the praying mantis can swivel around by 180 degrees, like an owl, to keenly scan its surroundings. Its front legs have evolved into claw-like structures covered with little spikes and hairs for grabbing prey. It lies in wait for its meal to walk or fly by and then, it strikes forward in an ambush attack! Their reflexes and the movement of their legs are lightning quick, and we can't always see these with our naked eye.

Praying mantises are also known for cannibalism, where the adult female may eat up her mate — just like in many spiders! She will do this for some extra nutrition to ensure her young ones are healthy. After this, the females lay hundreds of eggs in a little egg-sac. After a few days, nymphs emerge from these eggs, looking like miniature versions of their parents!



KEY

1: Lime tree

2: Egg sac and nymphs of a praying mantis



Don't be a nosy neighbour! Keep your distance and observe keenly — you may be able to watch the praying mantis hunt, clean itself and grow.

Are portions of leaves of your palm plant missing, or twirled around itself? Look around the plant carefully, and you might spot the culprit: the caterpillar of the giant redevye butterfly. The caterpillar's white thread-like extensions are made of a powdery substance that it secretes.

Palm plants are one of the host plants of the giant redevye. The female butterfly seeks out its host plant and lays tiny, dome-shaped white eggs on the leaves. When the caterpillars emerge from the eggs, they chomp away at the young leaves until it is time to wrap themselves inside a palm leaf.

You may not always see the butterfly as it is usually active during dusk. But if you do, notice its large proboscis and its large, red eyes. And observe the way it sits. Since it emerges during dusk, the giant redevye does not need to hold its wings open to bask in the sunlight like other butterflies.



Giant Redeye

The Leaf Roller

The filamentous white caterpillar may be tempting to touch, but the waxy threads could fall off as soon as you try to pick it up or hold it, leaving it without its clothing! The hungry caterpillars may chew up large portions of your plant's leaves, but may not cause enough damage to kill the whole plant, so fear not! It will eat its fill and soon, fly away.

KEY

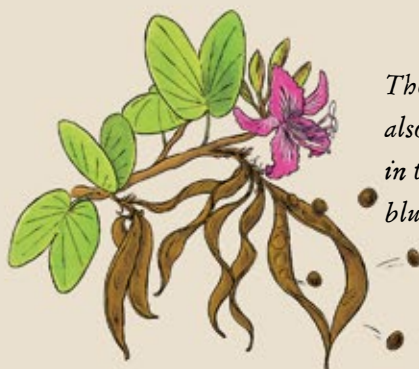
- 1: Giant redevye butterfly
- 2: Cocoon
- 3: Caterpillar
- 4: Egg

The commonly found blue pea is a creeper called *sangu pushpam* in Tamil because its violet-blue, or sometimes white, flowers (*pushpam*) look like conches (*sangu*). It belongs to the pea family, the same as green peas and chickpeas.

The plant has a special way of spreading its seeds which form inside seed pods. When the seed pods dry, they burst open, and like a spring, the seeds are thrown out and land far away from their parent plant.

Like other flowers, the *sangu pushpam* flowers have nectar and pollen, so you can be sure to see some insects visiting for a snack. Some frequent visitors are the busy blue-banded bee and the carpenter bee. You might also see the tell-tale cuts in the leaves left by a leaf-cutter bee at work!

Insects can recognise the shape, colour, size and smell of the flowers they like to visit. Brilliantly coloured flowers, like those of the blue pea help attract insect pollinators. If you look closer, the lighter inner portion of the flower has white lines called 'nectar guides' that help direct the pollinator towards nectar. These nectar guides are present in flowers of most plants, and can be easily detected by insects like bees which can see ultraviolet light.



The purple bauhinia also spreads its seeds in the same way as the blue pea.

Blue Pea

The Seed Exploder



Mud-dauber Wasp

The Puppeteer

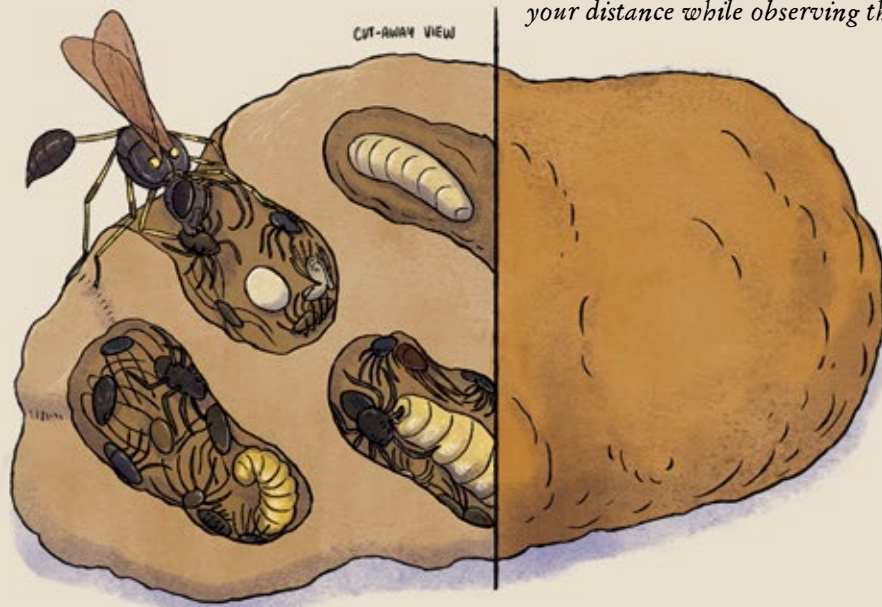


This insect architect specialises in sculpting, and its choice of raw material is soil. The houses that the mud-dauber wasp builds, however, are not for itself, but for its eggs. Just like the leaf-cutter bee, it is the mother that builds the nest and packs it with some ready-to-eat tiffin. This tiffin, though, is quite different from the leaf-cutter bee's.

The mud-dauber wasp paralyses insects and spiders by stinging them with a venom that turns her prey into an obedient puppet. She can then carry or even drag her prey to her nest, where she lays eggs on it. When the eggs hatch, they will have a live (although unconscious) meal to feast on! A mud-dauber nest can have five or more rooms, packed with spiders. Each wasp species builds a uniquely shaped house, and also specialises in hunting different kinds of prey.



Where can you find them? Sheltered spots in your verandah, on walls, or other surfaces around your house. Wasps sting only if they feel threatened. Don't be a nosy neighbour, keep your distance while observing them.



If you spot a little mud house, wait and watch! You might be treated to the mud-dauber wasp's expert home-making and hunting skills. If you are lucky, you might see nature's tricksters arrive at the scene. A cuckoo wasp might visit and lay its eggs in the mud-dauber's house without having to construct a house or catch prey itself.

KEY

1: Nest of Indian potter wasp;

2: Nest of black and yellow mud-dauber wasp



Nature's clean-up brigade arrives quietly at the scene of death and decay to help tidy up and recycle plant and animal waste. The black soldier fly is a key member of this brigade. Black soldier flies seek out and lay eggs close to decomposing waste.

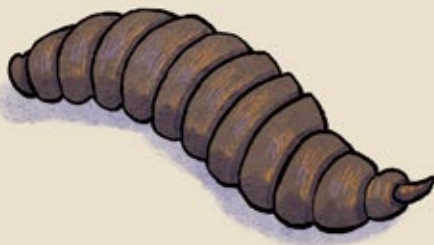
The newly-hatched larvae have one main activity: eating. The larvae break down plant and animal waste into nutrient-rich forms that can be absorbed by plants and other insects. It is the larvae of the black soldier fly that

Black Soldier Fly

The Clean-up Brigade



enthusiastically transform your kitchen waste into compost. When the larvae have completed their development, they look for a sheltered spot, form a pupa, and eventually fly away as adult black soldier flies.



2

Black soldier flies look similar to wasps, but they are true flies. Like the house fly, they have large compound eyes made up of thousands of simple eyes (as do wasps), but have only one pair of wings while wasps have two pairs.



KEY

1: Black soldier fly

2: Larva

Ant-mimicking Jumping Spider

The Undercover Agent



Do they bite? Ant-mimicking jumping spiders will likely jump away from you rather than give you a bite. Try not to touch it while counting its legs anyway!

It's an ant! It's a spider! Wait, what is it? This small, springing curiosity is a jumping spider that mimics, or copies, an ant. Ant-mimics are the most diverse group of spiders in the world with more than 80 different species. Each one of them convincingly mimics the way ants look, feed and move. They may even use their first pair of legs to resemble the antennae of an ant.

Luckily for us, they are not perfect copycats. On close inspection, you will see that these creatures have eight legs (not six, like most insects) and walk in a wobbly, jerky manner. They may even hop and jump once in a while. If you look closer still — aha! You might see eight eyes that are typical of a spider.

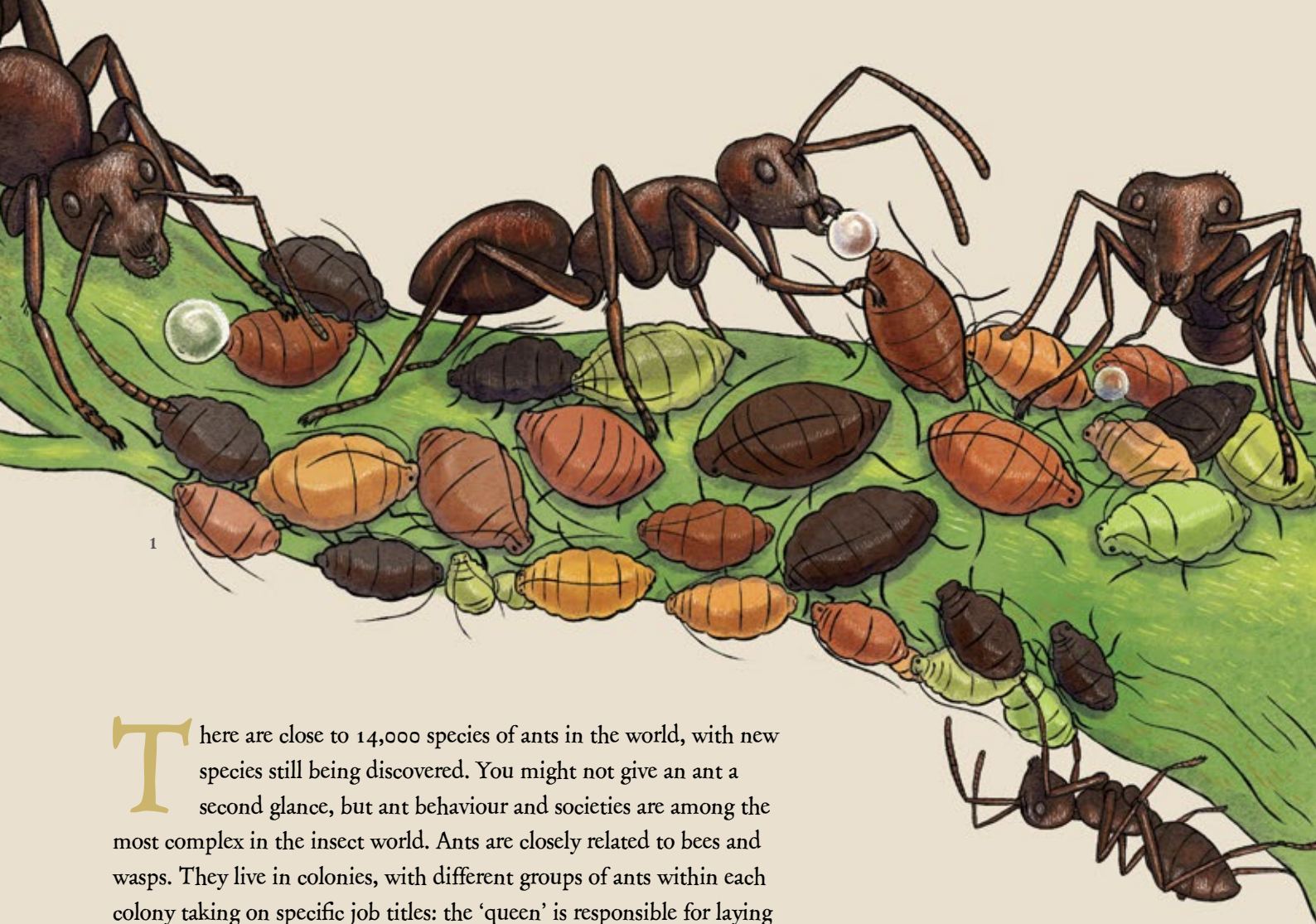
Why this elaborate deception? You may wonder. There are many advantages to being (or looking like) an ant. Ants often have nasty bites, and so, many insect predators like birds, wasps and small mammals tend to keep away from them. In fact, so many different creatures have evolved ways to mimic ants, that there's a special word for it — myrmecomorphy.

So when you see a busy army of ants rushing about near your house, zoom in to what's really happening — you may just find an odd one out, trying hard to fit in!



IN THE GARDEN





1

There are close to 14,000 species of ants in the world, with new species still being discovered. You might not give an ant a second glance, but ant behaviour and societies are among the most complex in the insect world. Ants are closely related to bees and wasps. They live in colonies, with different groups of ants within each colony taking on specific job titles: the 'queen' is responsible for laying eggs, while the 'worker' ants look for food and protect the colony.



2

Notice how an ant often waggles its antennae? This is one way it communicates. They can communicate danger, the source of food, or a call for help. Through pheromones detected through their antennae, they can even identify an intruder ant from a different colony!

You met the ant-mimicking spider that takes advantage of the ants' reputation of being aggressive. Some plants and insects also take advantage of this, but in a different way: they use ants as their guards. In return, the ants are offered sugary treats: plants offer nectar which they store at the base of their flowers and leaves, and some sap-sucking insects like aphids offer ants a sweet substance called honeydew.

Ants
The Social Organisms



KEY

- 1: Aphids
- 2: Planthopper
- 3: Nest of harvester ants
- 4: Nest of tree ants
- 5: Nest of *Myrmecaria* ants

Contrary to what you might think, most bee species do not live in large colonies like the honey bee. Of the 20,000 species of bees in the world, only 11 are honey bees. Most other bees lead solitary lives, like the leaf-cutter bee.

Honey bees traditionally build hives on tree branches or rocky cliffs. Since buildings in cities resemble rocky ledges, these bees have started building their homes in tall buildings and apartment complexes.



Honey Bee
The Belly Dancer



KEY

1: Honey bees carry pollen
in a structure on their legs
called a 'pollen basket'

2: Indian chrysanthemum

Most cities in India have three species of honey bees: the rock bee whose hives are commonly found hanging from buildings, the dwarf honey bee that makes small, circular hives in bushes, and the Asian hive bee which nests in cavities such as tree hollows.

Through an elaborate dance performed at the hive called the 'waggle dance', honey bees share information about where to locate nectar — their food. The other bees at the hive that witness this dance can then locate the nectar-bearing flowers by themselves.

Honey bee populations are declining across the world because of pesticide use, pollution and urbanisation. Planting native flowering plants and reducing pesticide use can help these dancing bees persist in our cities, and secure an important pollinator of our crops.

Honey bees sting only if they feel threatened. Don't be a nosy neighbour, keep your distance while observing them.



Common Tailorbird

The Sewing Machine

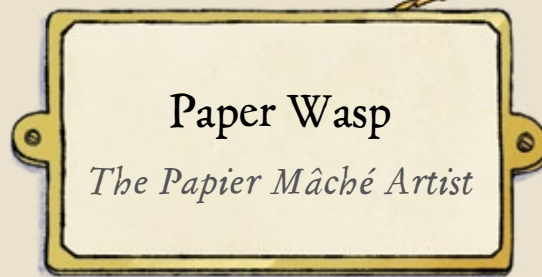
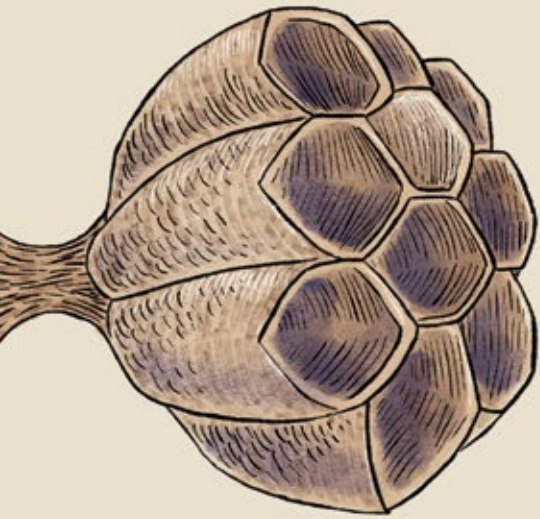


If you follow a shrill 'tiii-tiii-tiii' call to its source, you will see a little songbird called the common tailorbird. It has a rusty-red cap, and usually holds its tail upright while it perches.

You are probably wondering why it is called the tailorbird. This tiny bird stitches leaves together to form a cradle for its nest. Silk from a spider's web or fibres from plants form the 'thread', and the tailorbird's thin, sharp beak acts as the needle. Male tailorbirds help make the nest inside this cradle with soft materials like plant fibres and cotton. Once they have mated, the female tailorbird lays 3-5 tiny eggs in the nest. When the chicks hatch, the male and female tailorbirds take turns to feed them insects. The chicks soon begin to accompany their parents on short trips and learn how to hunt insects.

Even though insects like butterflies, beetles or grasshoppers are their first choice of food, common tailorbirds also relish the occasional fruit or berry, and especially enjoy the flowers of the mango tree. No matter what city you are in or, you're sure to come across these little, loud birds if you keep your eyes and ears open.

Where can you find them? Flitting about in low trees or shrubbery.



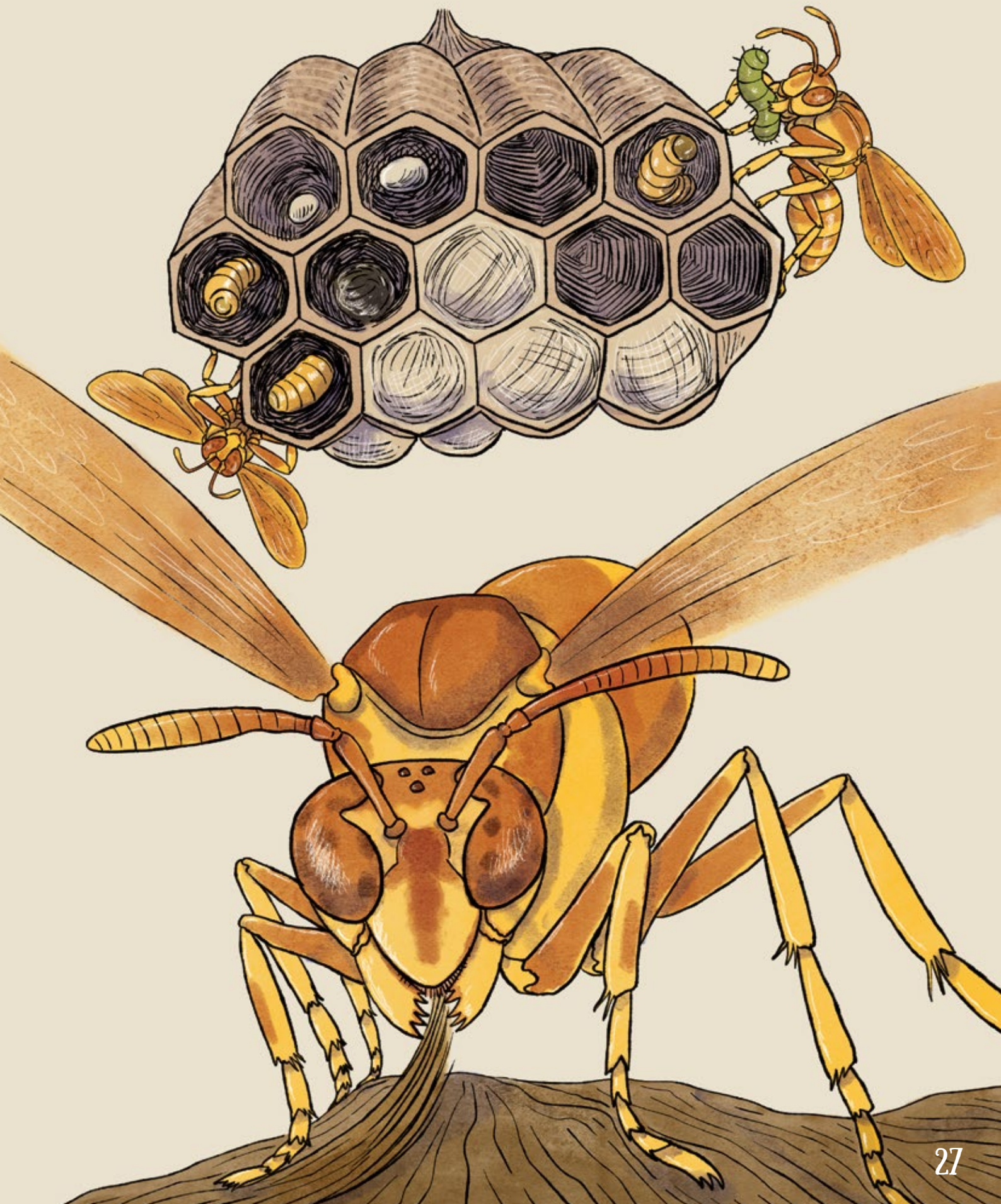
The paper wasp specialises in making paper-like nests with fibres from dead wood and plant stems, which it mixes with saliva.

To start a new wasp colony, a nest is constructed by a solitary female called a foundress. The foundress lays her eggs and forages for juicy insects to feed her growing larvae. The larvae grow to be female workers who help the queen grow her colony and raise more larvae to adulthood. Finally, a smaller number of eggs are laid to produce male wasps who lead nomadic lives and mate with other foundresses, thus continuing this cycle.

These architects are important parts of urban ecosystems. You can thank them for keeping the caterpillars in your garden under control. They occasionally feed on nectar from flowers, thus pollinating plants in the city.

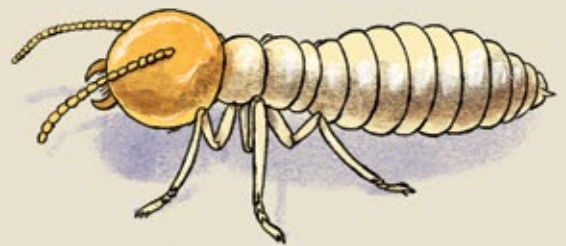
The yellow paper wasp is one of the most common paper wasps.

Where can you find them? Sheltered spots in your garden, on walls, windows or doors. Wasps sting only if they feel threatened. Don't be a nosy neighbour, keep your distance while observing them.

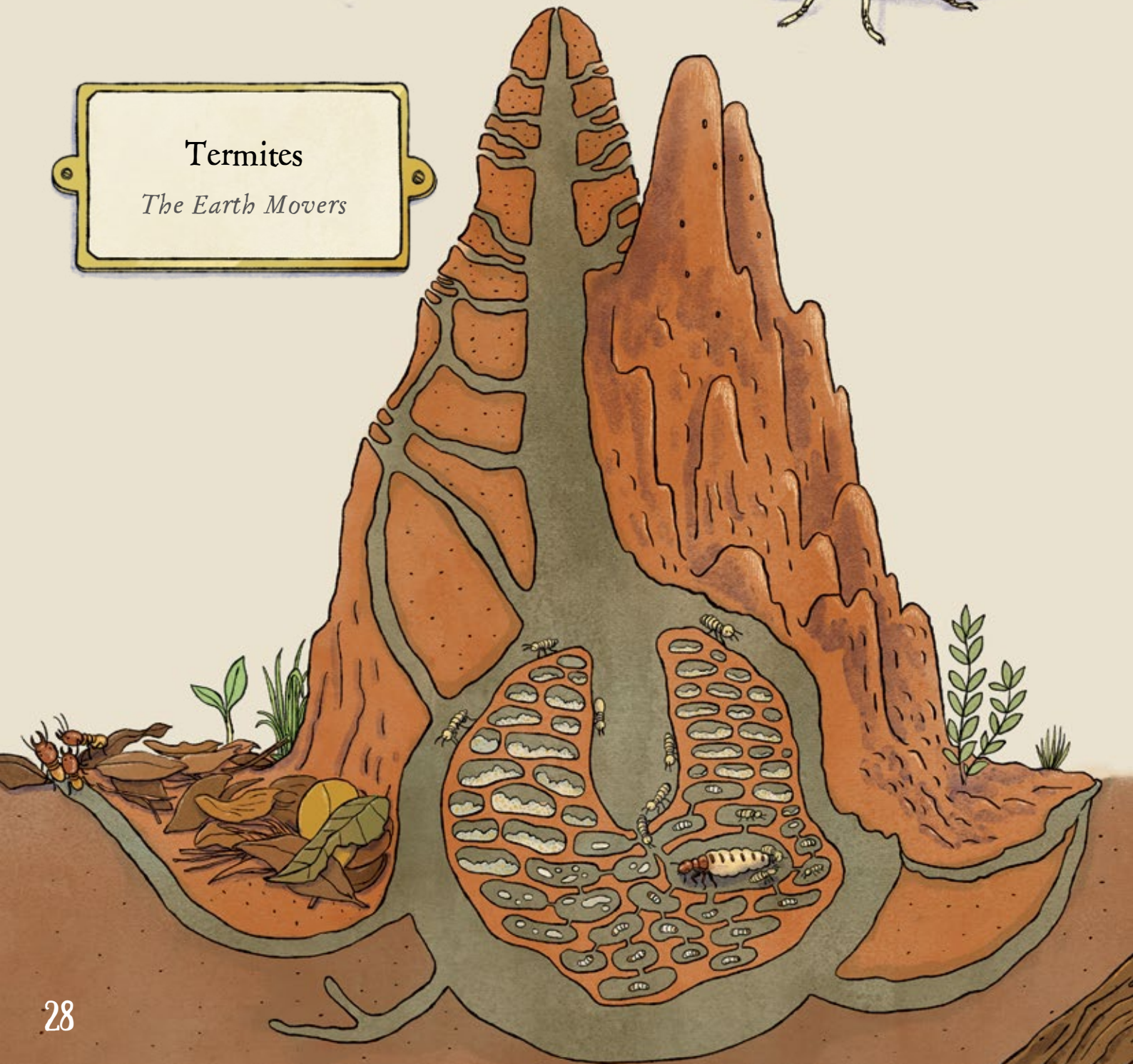




1



Termites
The Earth Movers



This army of recyclers feed on dead plant material (including old wood), fallen leaves or even animal dung, transforming them into useful nutrients. There are over 2,000 species of termites in every landmass on the planet except Antarctica.

Termites form colonies of just a few hundred individuals to several million. Each colony of termites has a fertile 'queen' and several 'workers' or 'soldiers'. The queens are some of the longest lived insects in the world, often living up to 50 years of age.

Some termite species build impressive mud mansions that reach up to 5 meters in height, using over 250 kilograms of mud and water. Only a cooperative community could work together to create such a skyscraper that houses nearly 15 kilograms worth of termites all put together. Inside the mounds, termites sometimes 'farm' by growing different kinds of fungi which they then feed on. They build their mansions such that the temperature inside remains between 25-36°C — perfect for this kind of farming.

Winged termites are in charge of reproduction and starting new colonies. When the conditions are right, they emerge in large swarms from different colonies and mate, losing their wings in the process. The mated male and female are the 'king' and the 'queen' and they start a new colony of their own.

Where can you find them? Around dead trees, old furniture, or in large termite mounds in parks, campuses or empty plots.



KEY

- 1: Termites with different job titles look different too
- 2: Winged termite





The tall stalk-like structures release spores into the air. Spores are like seeds, but simpler: they do not contain stored food. Spores grow into moss when they land on a moist, favourable surface.

Growing in plain sight amongst us are the most primitive of plant forms. Mosses are very different from other plants, because they have no flowers, roots, seeds or fruits. They give us a peek into what plants may have looked like when they were first evolving to grow on land.

Without roots, mosses cannot draw water from the soil. Instead, they grow in damp or moist places, where they rely on water from rain, or even a leaky water tank. They absorb this water through tiny leaf-like structures. Because mosses retain water almost like a sponge, they keep the soil moist and help other plants grow. Mosses can also dry out for long periods of time and spring back to life with a little bit of moisture. Their simple survival strategy seems to be a winning one, because you will find mosses in a range of different environments, from cold Antarctica, to hot deserts.



Skinks are sleek, shiny and slippery lizards. They may even look like a tiny snake slithering away, which is why they are called *haavu rani* (snake queen) in Kannada and *saap ki mausi* (snake's aunty) in Hindi. Just like a snake does, it dashes for cover as soon as it sees something or someone threatening.

Skinks mostly spend their time underground or hidden in leaf litter. It is easiest to see them during the day, when they are out, like other reptiles, basking in the sun to absorb heat, or searching for small insects to eat. Since they spend so much time covered in dirt, skinks have a transparent lower eyelid that allows them to see even in hiding. Many skinks have especially bright tails to distract predators from attacking their head. If a predator tries to grab its tail, the skink simply detaches it in a hurry — leaving just its tail wiggling behind while it slinks away into hiding yet again. After all, they can regrow their tails eventually.

Skinks don't live in houses and buildings like house geckos do. So when we chop down trees or get rid of little patches of greenery around the city, they lose their habitat.

Where can you find them? In gardens, by lakesides or even in leaf litter by the roadside.

Skink

The Noodle Lizard



The coo-coo of the Asian koel, that rises up to a fever pitch, is as much a part of our cities and towns as are honking vehicles and loud construction noises. Although its call might give it away, the koel is secretive, preferring to skulk in tree canopies.

Just a glance is enough to notice that the male and the female birds look different. The female koel's dull and blotchy colours helps her hide among the leaves, making her hard to spot. Female birds in general tend to be dull coloured to escape predation while they nest.



2

1

KEY

1: *Neem tree*

2. *Female koel*

3. *Male koel*



Asian Koel

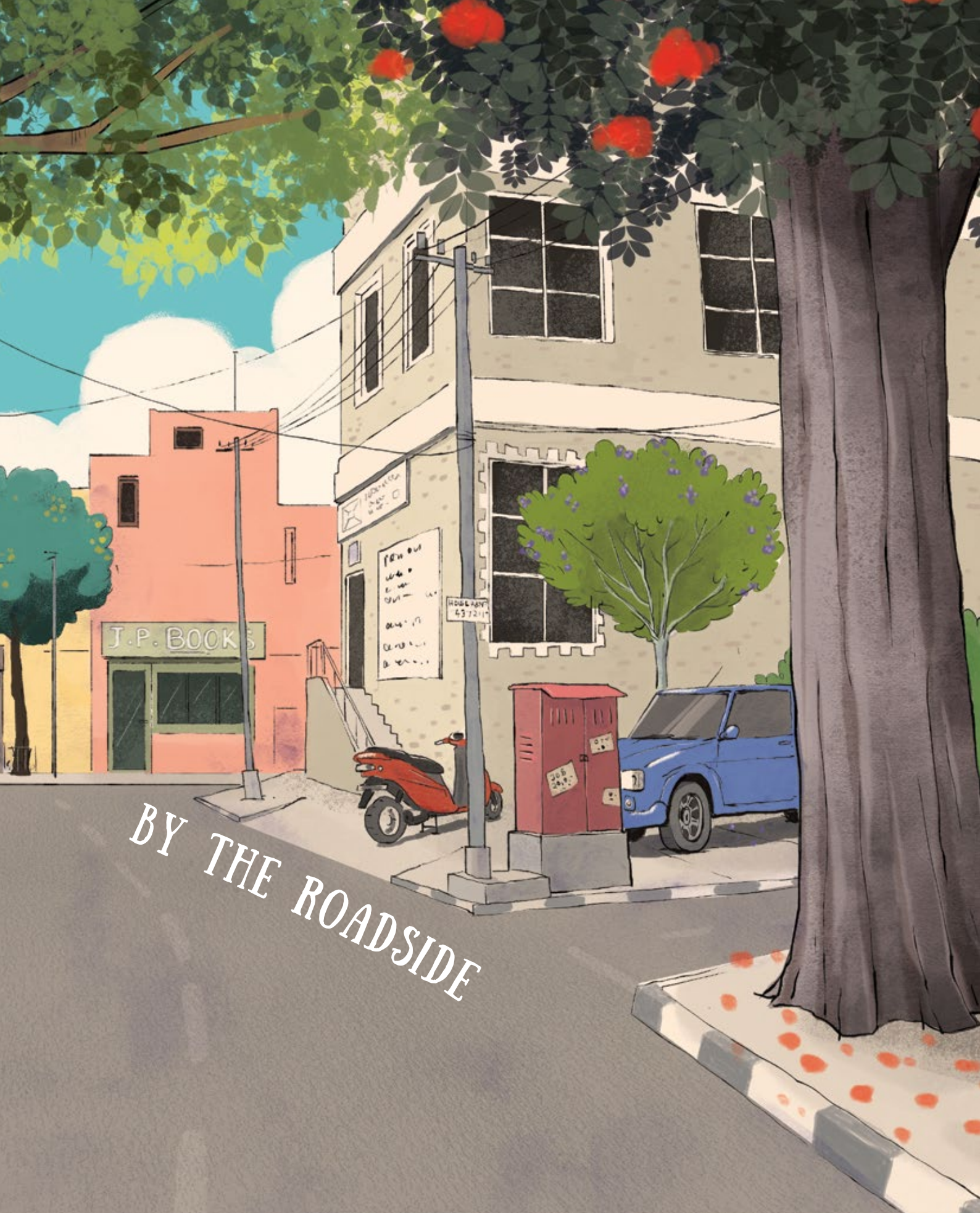
The Sneaky Parent

But here is where it gets interesting with the koel. It does not build a nest or raise its chicks!

The koel is called a brood parasite — it lays its eggs in the nest of a different species. The female koel often chooses the nest of a house crow or jungle crow to lay her eggs in. To get away with this, her eggs look very much like the eggs of the crow.

Koels and crows have evolved several ways to outsmart each other in this game of brood parasitism. Crows sometimes abandon their nest if they realise it has been parasitised. And koels sometimes remove the eggs of the crow before laying its own eggs. The chicks of the koel are also part of this game: they mimic crow chicks and may even push the chicks of the crow out of its nest after they hatch!





BY THE ROADSIDE



Peepal Tree
The Mini Ecosystem

The sprawling peepal tree grows as tall as multi-storied buildings and lives for several decades. You have probably seen its heart-shaped leaves dancing in the wind, but have you ever wondered why you can't see its flowers?

The peepal is a fig tree, and like other fig trees, the flowers of the peepal are hidden inside white or green circular fruit-like casings. So, how do its flowers get pollinated if they are hidden?



Fig trees rely on tiny pollinators that know how to get inside this flower casing: fig wasps! Each species of fig is pollinated by a unique species of fig wasp. They have evolved together to form a close relationship, because of which neither species can survive without the other.

Female wasps emerge from eggs laid inside the flower casing. When they are fully grown, mated and ready to leave the casing, they collect pollen from the flowers on their way out. Then, the females have just a few days to find another casing, lay eggs and pollinate fig flowers, before they die.

KEY

1: *Rose-ringed parakeet*

2: *Palm squirrel*

3: *Brown-headed barbet*

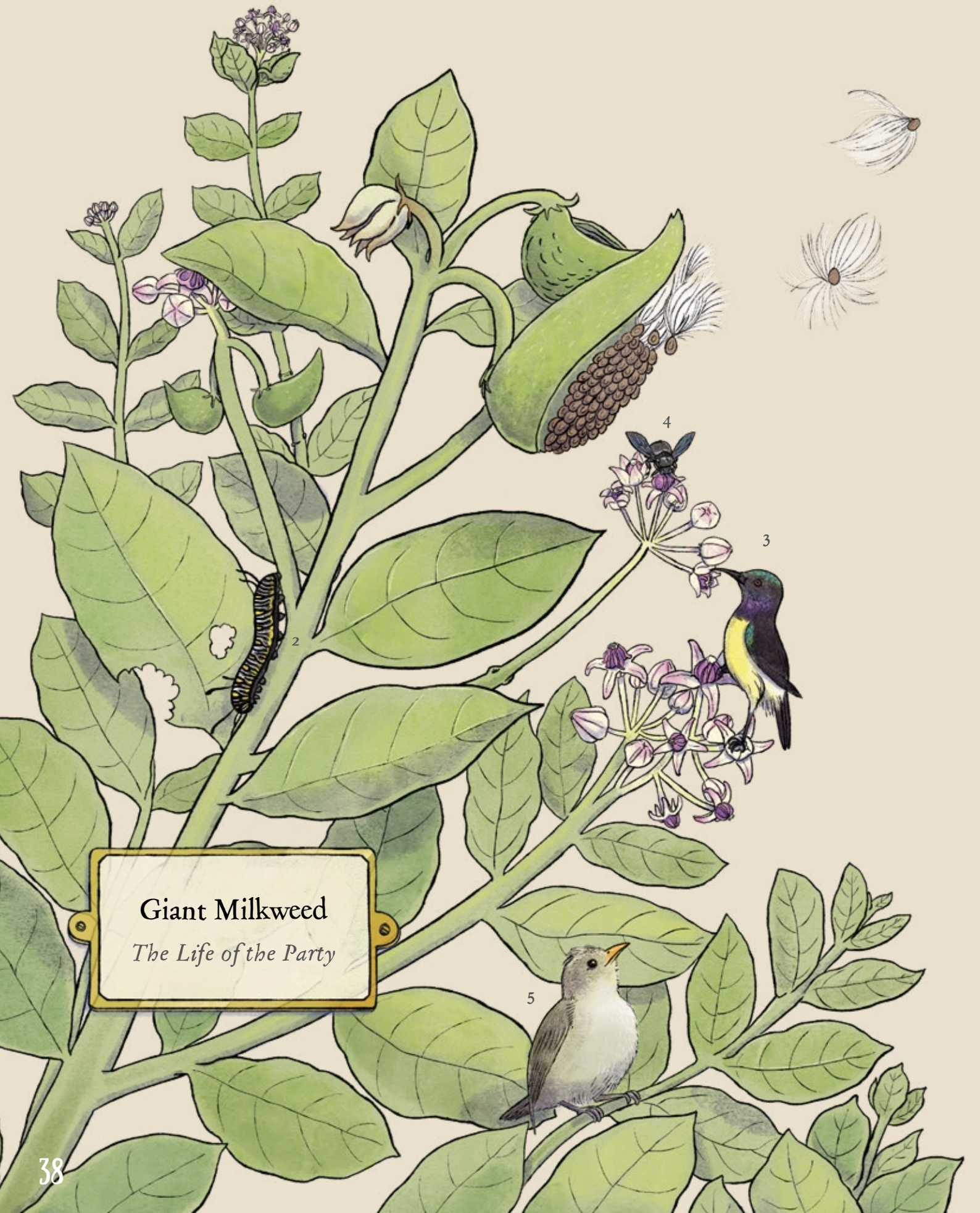
4: *Fig wasp*

5: *Peepal trees, like other fig trees, do not need a lot of soil to grow. That's why you can see them growing in odd places like cracks in the wall, or on other trees — almost anywhere where bird or bat droppings land!*



The fig tree has other friends too. Many birds, bats and squirrels eat its fruits, and help spread the seeds of the tree far and wide. The tree also hosts insects and reptiles which hunt and nest in their branches and roots, making the tree an ecosystem in itself.

Fig trees are special because the flowering and fruiting time of each tree is different. This means that there is a ready supply of flowers and fruits for the fig wasps and other friends of the trees throughout the year. This makes fig trees like the peepal extraordinarily important for the environment.



Giant Milkweed

The Life of the Party



KEY

- 1: Plain tiger butterfly
- 2: Plain tiger caterpillar
- 3: Purple-rumped sunbird
- 4: Carpenter bee
- 5: Pale-billed flowerpecker



If you stop to investigate the giant milkweed, you will find that you are not the only visitor. You might see the brightly coloured caterpillar of the plain tiger butterfly chomping away on the leaves of its host plant. The plain tiger caterpillar absorbs toxic substances from the giant milkweed to store in its body. This makes the caterpillar unpleasant to eat, and its bright colours are a warning to its predators: 'Don't eat me! I taste bad!'

Other insects are attracted to the giant milkweed for its nectar. The plain tiger flits from one flower to the next, extending its tongue-like proboscis into the flowers for nectar. The carpenter bee dreamily flies between different flowers, and the sunbird dips its long beak and tongue into the flower while hovering alongside.

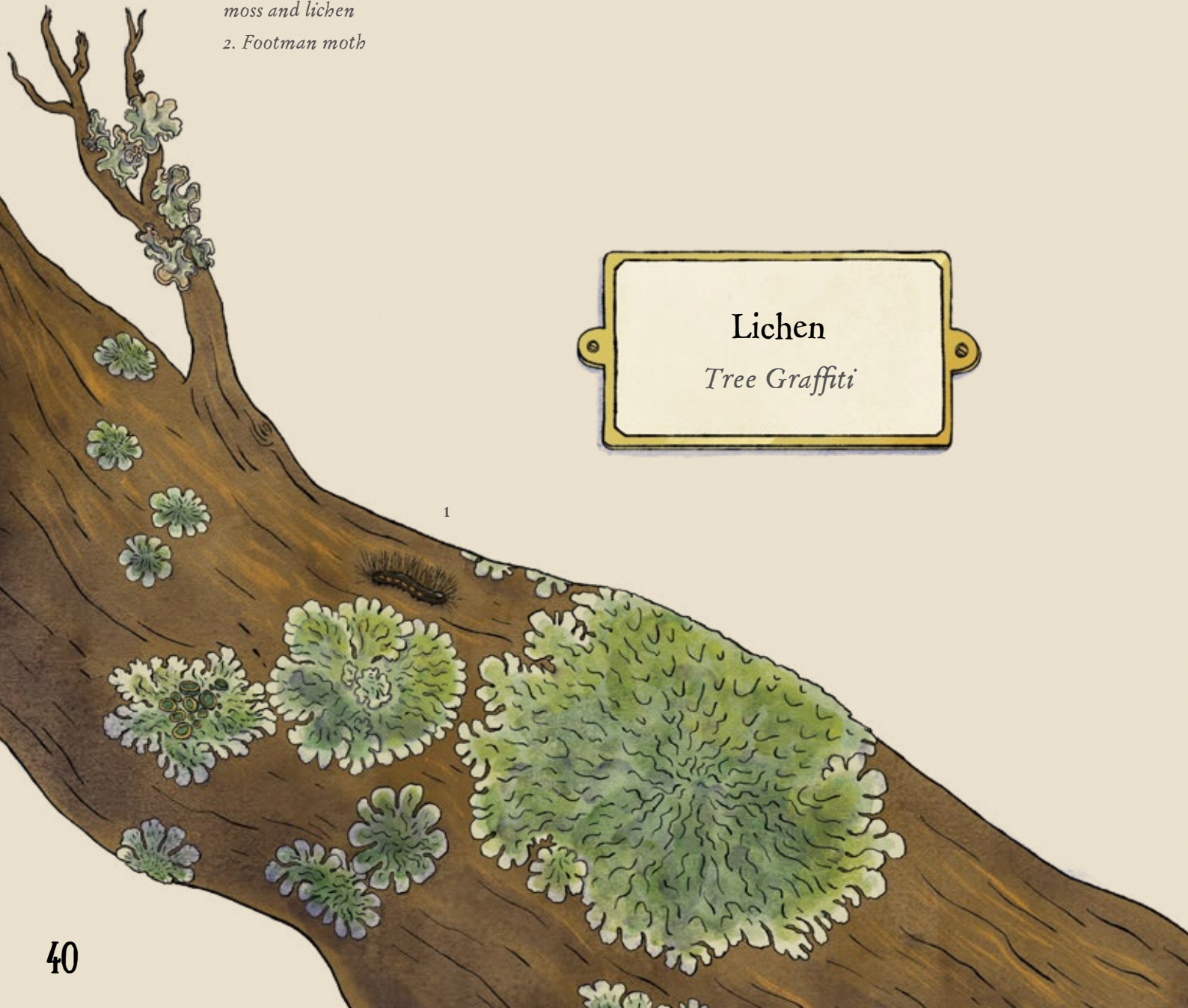
The seeds of the giant milkweed are spread with the help of the wind. The seeds have fluffy white hairs which the wind can easily carry and deposit far from the parent plant. Because of their white 'beards', the seeds of the milkweed are called *appuppende thaadi* (grandfather's beard) in Malayalam. Many birds like the pale-billed flowerpecker and sunbirds, use these 'beards' as their nesting material.

Where can you find them? Growing by the side of the road or in an empty plot.



KEY

- 1: The larvae of the footman moth feeds on
moss and lichen
2. Footman moth

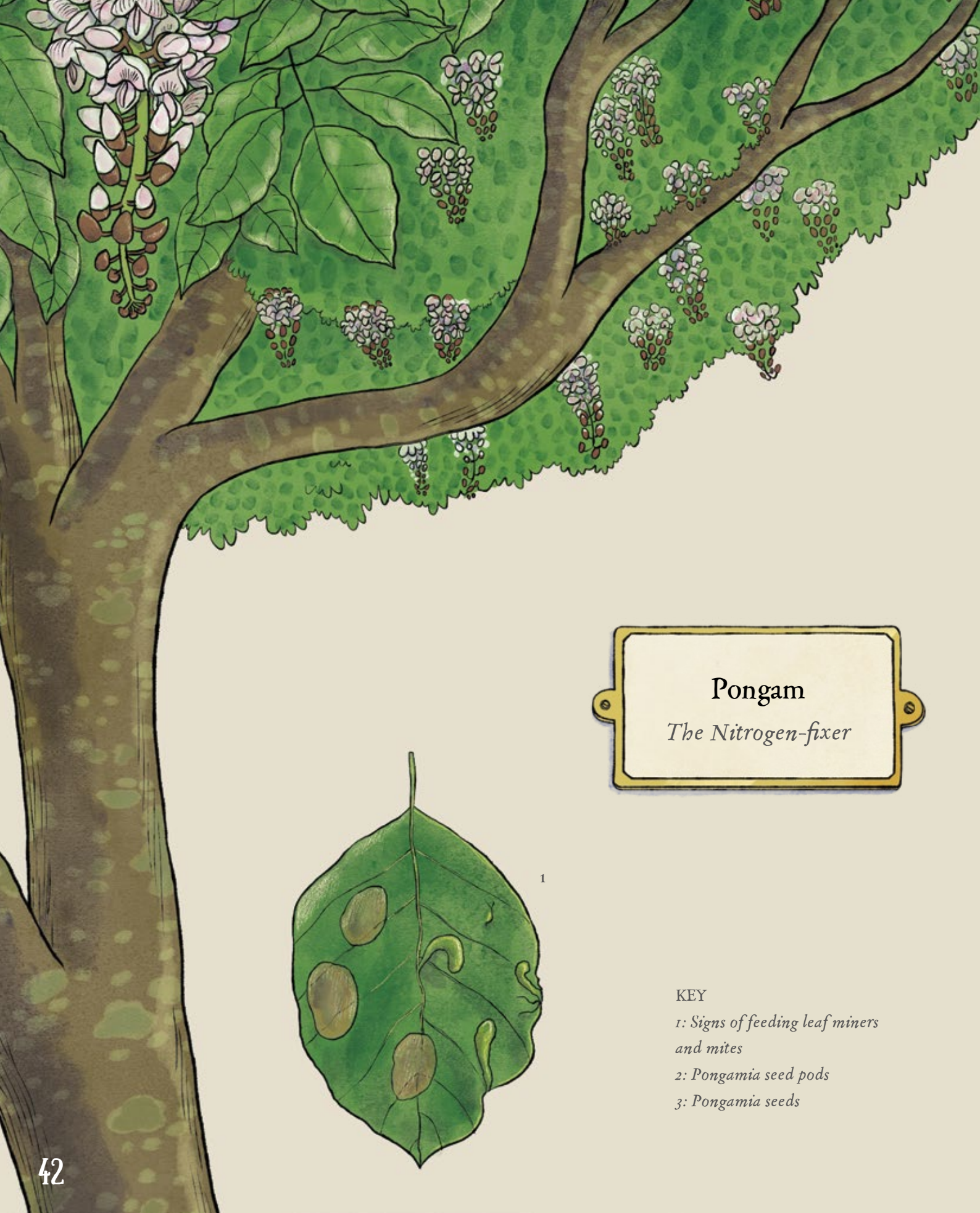


Have you noticed squiggly flat patches covering tree trunks, especially in the monsoon? If you look closely at these amoeba-shaped blotches, you'll see that it's not just a strange discolouration, but a living marvel. These are lichens, but each one is not a single organism. They are a partnership of algae and multiple species of fungi. The fungi and the algae provide food for each other and produce chemicals that ward off predators. This cooperative system is called symbiosis, and in the case of lichen, the partners are so well integrated that you can't tell them apart! Together, they become a composite organism and function in new ways which are unique to their partnership.

Algae and fungi combine in many ways, with different combinations of species coming together to form lichen under different circumstances. Because of this, 6-8% of all the land on earth is covered by more than 20,000 species of lichen! You can find lichen anywhere, from humid areas at sea level to cold mountainous areas. They grow on different kinds of surfaces, like rocks, tree barks, leaves, man-made buildings, and even on other mosses or lichen.

Lichens are long-lived and grow at a slow rate, so a single lichen may live for hundreds of years if undisturbed.

If you spot a patch of lichen, use a magnifying lens to observe it up and close. Keep an eye on some neighbourly lichen and see if it grows over time!



Pongam
The Nitrogen-fixer



KEY

- 1: Signs of feeding leaf miners and mites*
- 2: Pongamia seed pods*
- 3: Pongamia seeds*



It is quite likely that you have enjoyed the pongam tree's leafy shade, or admired the carpet of flowers below it during its flowering season. This tree is semi-evergreen, which means that it loses all its leaves only for a very short period during the year. It belongs to the pea family (you met one of its relatives earlier). Plants in the pea family are called legumes, and they share similar characteristics: their seeds are tucked away in pods and their roots provide a home for a special kind of bacteria. This bacteria fixes nitrogen, an essential element for plants, from the atmosphere into the soil. In return for the nitrogen, the plant provides food for the bacteria.

You will often notice strange lumps, and circular or wavy brown patches on the leaves of the pongam tree. The culprits of these leaf decorations are small insects. The patches in the leaf are made by insects called leaf miners — flies and moths whose larvae eat away at plant tissue. The finger-like lumps are caused by mites (creatures closely related to spiders) that feed on and lay eggs in leaves. Even though they seem to decorate nearly every leaf, these critters are harmless to the pongam.

Where can you find them? Growing along rivers, or providing much-needed shade by the roadside in cities.

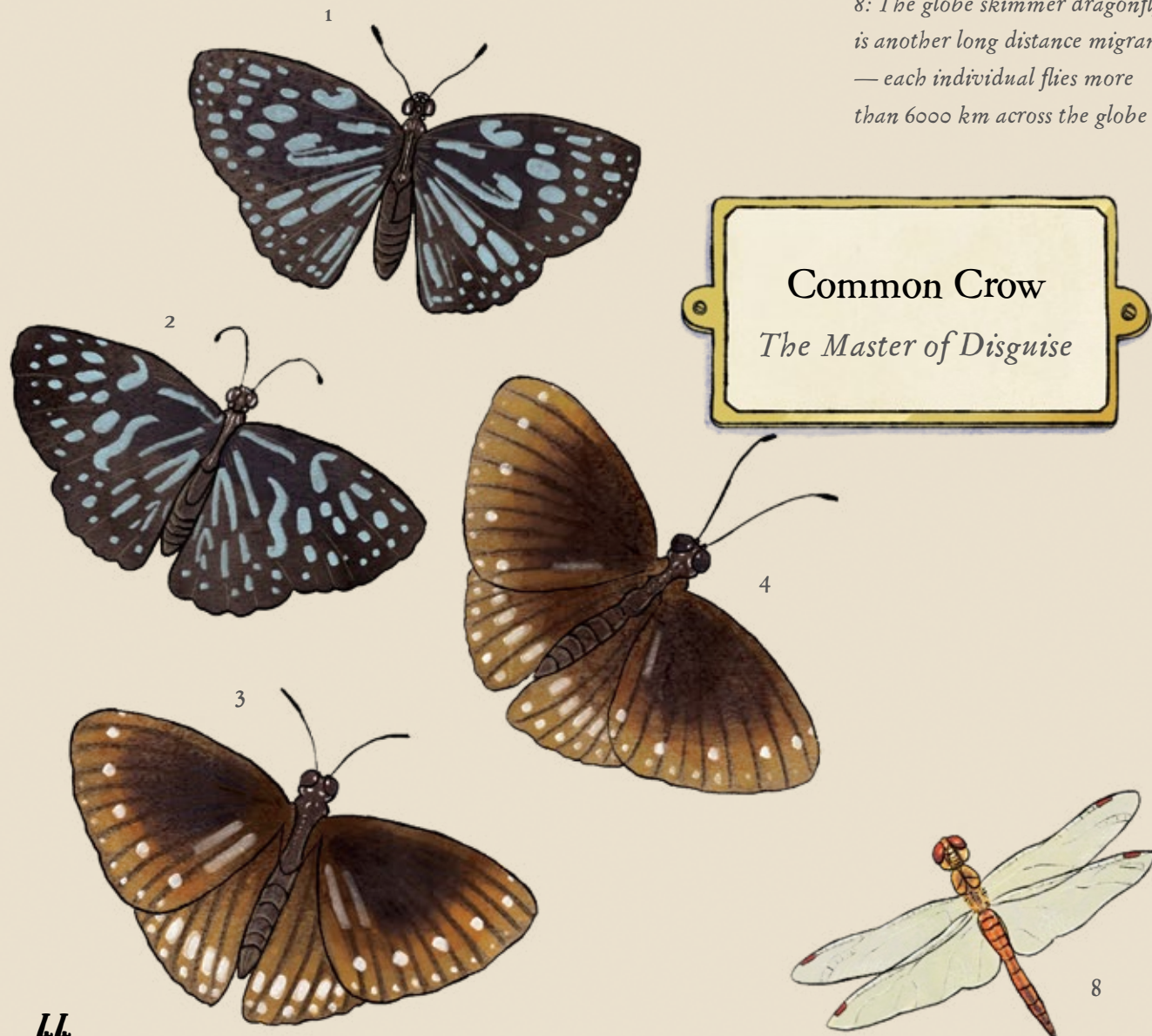


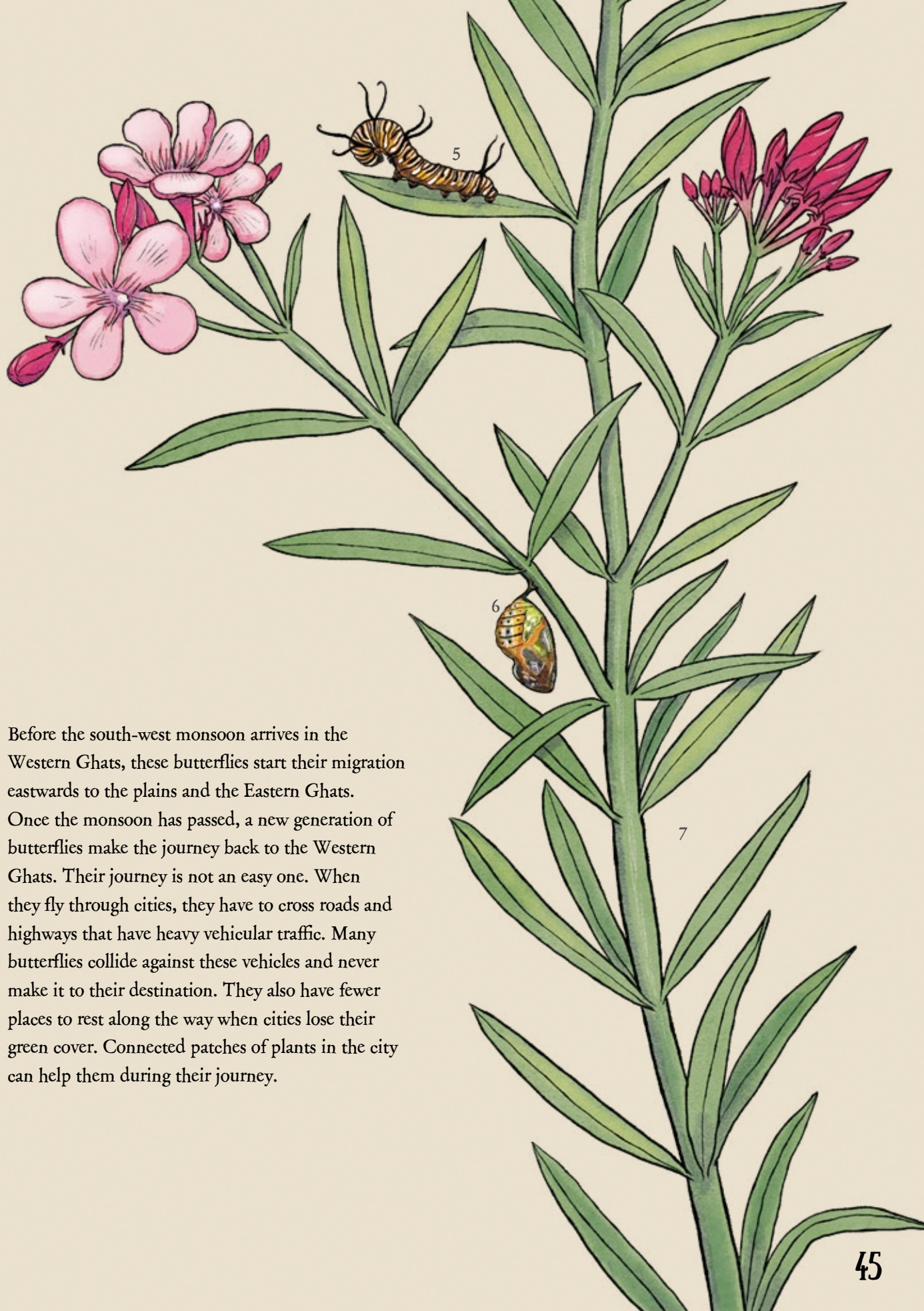
This butterfly may have an unremarkable name, but it is capable of an astonishing feat. Every year, the common crow, along with a few other butterflies, migrate between the Western Ghats, the Eastern Ghats and the plains in-between — a distance of 500 km!

You can't miss them during the migratory season. Huge swarms of them can be seen flying across cities in South India.

KEY

- 1: Common crow
- 2-4: Butterflies that migrate with the common crow
- 2: Blue tiger
- 3: Dark blue tiger
- 4: Double-banded crow
- 5: Common crow caterpillar
- 6: Pupa of the common crow.
The pupal stage occurs between the larval and adult stages.
- 7: Oleander is one of the host plants of the common crow
- 8: The globe skimmer dragonfly is another long distance migrant — each individual flies more than 6000 km across the globe





Before the south-west monsoon arrives in the Western Ghats, these butterflies start their migration eastwards to the plains and the Eastern Ghats. Once the monsoon has passed, a new generation of butterflies make the journey back to the Western Ghats. Their journey is not an easy one. When they fly through cities, they have to cross roads and highways that have heavy vehicular traffic. Many butterflies collide against these vehicles and never make it to their destination. They also have fewer places to rest along the way when cities lose their green cover. Connected patches of plants in the city can help them during their journey.



You will probably hear the loud buzzing of the carpenter bee before you see it. The carpenter bee is a plump, solitary bee named after its style of nest-making: the female bee drills neat, round holes in dead or decaying wood with its strong mouth parts. These nests are filled with pollen and nectar before the bee lays her eggs inside. The mother bee is the chief architect and the security guard of her nest, although her daughters sometimes share guard duty. The males, meanwhile, hover close to the nests or near flowers, in the hope of finding a female bee to mate with. If you see a carpenter bee perched on a twig or branch with its wings held out, it is quite likely a male patiently waiting for a female.





Carpenter Bee

The Woodworker

KEY

1: Carpenter bees carry pollen on fine hairs on their legs and bodies

2: Eggplant

Carpenter bees pollinate a variety of flowers — you might see them sleepily flying around the Nile tulip, milkweed or bauhinia. They have different ways of accessing nectar and pollen from flowers. In plants like tomato and eggplant, the pollen is firmly tucked away inside flowers. To dislodge the pollen, the bee uses a trick called ‘buzz pollination’: it holds the flower and rapidly beats its wings, making the flower vibrate. This shakes loose the pollen which falls on the bee and is then transferred to other flowers or to the bee’s nest. Carpenter bees can also be ‘nectar robbers’ when they make a hole at the base of a flower to ‘steal’ nectar without pollinating the flower in return.

The carpenter bee stings only if you try to touch it or get too close. Don’t be a nosy neighbour, keep your distance while observing it.





Black Kite

The Scavenger

Often mistaken as an eagle, the black kite is one of the most commonly seen raptors in our cities. A raptor is a bird of prey that catches other creatures like birds or mammals for food. However, this majestic bird will eat just about anything, sadly, even garbage!

Like many other large raptors, black kites use hot air thermals that rise off the earth's surface to support them, and so they don't need to flap their wings to stay airborne. The thermals carry them higher and higher into the air, allowing them to use their keen vision to scan large expanses of ground below them for food.

Black kites put on an impressive display while breeding. They fly high up into the sky and call out loudly to potential mates. When they pair up, they interlock their talons and fly through the air downward together in a spectacular display. The pair then makes a bulky nest of sticks close to a tree's trunk, and share chick-rearing duties.

Find them seated atop buildings or soaring above lakes or garbage dumps.





You've seen mushrooms in many places — adorning a tree or growing out of the ground. You even eat them. But what are they — plants or animals? The answer is neither! Mushrooms belong to a kingdom of living beings called fungi.

Mushrooms cannot make their own food, and so they feed on dead organic matter. They break down these complex foods into their simpler building blocks such as water, nitrogen and carbon dioxide. These substances are then returned to the soil for the plants and other organisms to use.

The mushrooms that we see poking up from the ground or tree are 'fruiting bodies' that produce 'seeds' or spores. Each species of mushroom has a differently shaped fruiting body, from umbrella-shaped mushrooms to semi-circular plates that line tree trunks.



If you look under the cap of the mushroom, you might see thin lines called 'gills'. These hold spores which are released into the air, and grow into mushrooms when they settle on the ground. The rest of the mushroom is underground or in wood — a network of thread-like structures where all the work of cleaning up and breaking down organic matter occurs.

Underground, and out of sight, a different kind of fungi called mycorrhiza ('*mykes*' in Greek means fungus and '*rhiza*' means root), form a symbiotic relationship with plants. These fungi intertwine with the roots of a plant to form a network connecting different trees. This helps trees exchange minerals, water, and even warnings about diseases or plant-eating insects. In return, the trees provide these helpful fungi with sugar produced through photosynthesis.

There are millions of other species of fungi in the world, including parasitic fungi that live off other organisms, and yeast — a single-celled fungus which helps make your bread.

Fungi
Every Plant's BFF

KEY

- 1: Mycorrhizal fungi
- 2, 3: Bracket fungi
- 4: Bird's nest fungi



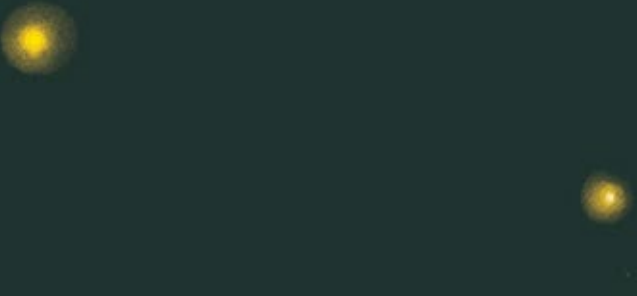


A night scene featuring a large, leafy tree on the right side, decorated with small, round ornaments. The sky is dark blue with a crescent moon in the upper right corner and several small white stars. Two brown bats are flying in the sky, one larger and more prominent in the upper center, and another smaller one to the left. In the foreground, there is a dark, silhouetted fence or wall. The overall atmosphere is serene and nocturnal.

NIGHT AT THE LIVING MUSEUM



Fireflies &
Glow Worms
The Fairy Lights



As the summer heat fades and makes way for monsoon showers, tiny magical creatures gear up to dazzle one another. At night, they look like floating lights, twinkling like stars. These are fireflies (males) and glow worms (females), and they produce light through a process called bioluminescence.

You're probably wondering why there are different names for the male and female of this species. Both of them are very different from each other. The males have wings and they are the ones you see flying about. They feed on pollen from flowers, and so help pollinate plants. The females, on the other hand, don't have wings. They live on the ground or in bushes. They attract the males down to where they are by flashing lights in distinct patterns. Glow worms feed on other insects and hide in the soil as ambush predators. The females may even flash their lights in a way that attracts fireflies of a different species, tricking them so that the glow worms can catch them as food!

Where can you find them? Empty plots, gardens or patches of trees and grass, away from harsh city lights and sounds.

KEY

1: Firefly

2: Glow worm





Only about eight inches tall, the spotted owlet is one of the smallest owls you can see in India. These little birds are quite common in our cities, and are often found roosting in pairs in scrubby patches or nooks in building walls. They are brown coloured and have white speckles on their heads and down their backs. They also have clear white eyebrows above their large, round eyes that make them striking to look at after dark.

They are most active at dusk when they make a wide variety of calls. Sometimes it sounds like they're laughing, making loud 'chirurr-chirurr' sounds, while at other times they let out high-pitched cackles which can startle you! These owls, along with barn owls, like living in the dry and open habitats that a city provides. These places allow them to find ample insects and small animals to feed on. Even though they aren't as large and intimidating as raptors like the Black Kite, they are still efficient predators. So other birds may raise an alarm and try to chase them away from their roosts during the day.

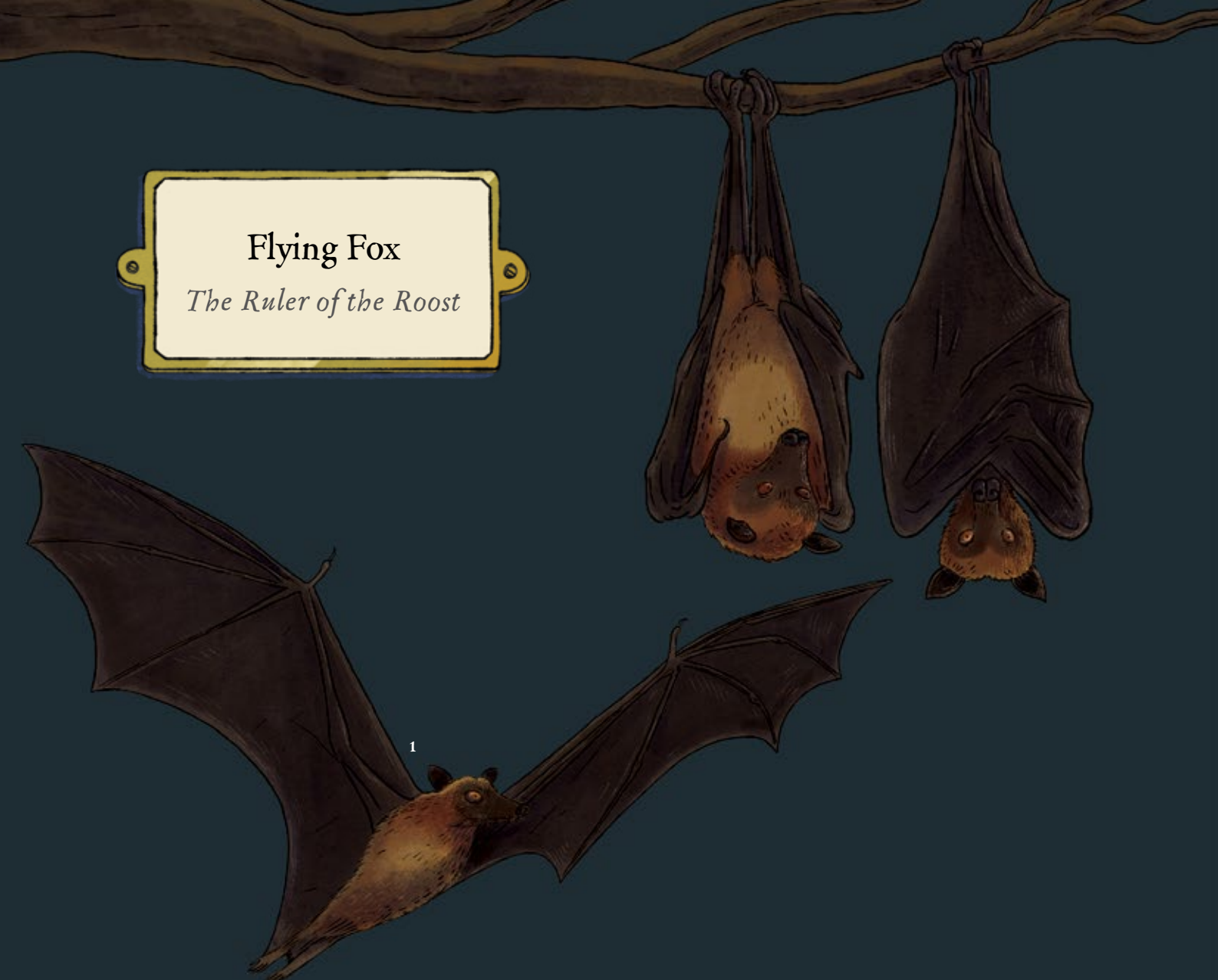
Don't be a nosy neighbour! If you disturb them during the day, they will bob their heads and stare at you, the intruder, which is your sign to leave them alone!



Spotted Owlet

The Night Hunter



An illustration of three flying foxes. One is shown in flight at the bottom left, with its large, dark wings fully extended. Two others are roosting upside down from a thick, brown tree branch at the top of the page. The bat on the left is larger and has orange-brown fur, while the one on the right is smaller and has darker fur. A yellow-bordered text box is positioned in the upper left quadrant.

Flying Fox

The Ruler of the Roost

Those large-winged creatures that emerge at dusk in big groups, flying high in the night sky, are not birds. They are bats, and like you, they are mammals — with the fun addition of being able to fly! Flying foxes are one of the largest bats in the world. The ‘fox’ in their name comes from their fox-like orange-brown fur and long snout.

When dusk falls, flying foxes start chatting and shrieking noisily. Together, they leave their roosting tree and set out to feed on fruits and nectar, using their good sense of smell and vision to find fruiting and flowering trees.



KEY

- 1: *Roosting flying fox*
- 2: *Oleander hawk-moth*
- 3: *Mango tree*

The seeds of eaten fruits remain intact in the bats' poop. These seeds are spread far and wide because of the long distances bats travel. This is how plants reach new places! Flying foxes can transport seeds as far as 100 km away from where they feed on fruits.

Flying foxes also drink nectar from trees like the white silk cotton tree and banana that bloom at night. They are often treated badly because of superstition and the tendency of bats to carry diseases that can affect us. This is unfair, because it is the changes that humans make to bat habitats that bring us into closer contact with bats. But even in cities, where we live alongside many species of bats, they prefer to remain aloof and avoid contact. Just remember not to eat fruits that look like they have been already eaten, or drink sap from a bat-pollinated tree, and bats can remain our friendly neighbours.

Where can you find them? Flying foxes spend the day roosting upside down in large trees like the peepal, banyan and rain tree. You are very likely to see them flying to their feeding ground or back to their roosting site late in the evening or at night.



1

Short-nosed Fruit Bat

The Fruit Tracker



If you look under the floppy leaves of a banana tree, you just might just see the beady eyes of short-nosed fruit bats looking back at you. This small fruit-eating bat lives in small groups or colonies of 3-4 bats, but in a few cases, there may be up to 25 bats living together.

After sunset, the bats wake up and stay active through the night. They fly low and fast as they use their strong sense of smell to look for fruits. Depending on the season, they feed on chikoos, bananas, lychees, mangoes and guavas. Just like the other fruit bats, they too help with the distribution of seeds through their droppings. They also pollinate the flowers that they visit for nectar.

Before the breeding season, single male bats use plant stems to create little 'tents'. The male, 2-3 females and their pups (young bats) live in this tent where they hang upside down from the roof. After the pups are born and start to grow, the males leave and form their own groups.

Where can you find them? Agricultural areas, parks and gardens. They are often found roosting in crevices of banyan or peepal trees.



2



KEY

1: Banana tree

2: Singapore cherry



Indian Pipistrelle

The Echolocator

There is another group of bats that eat insects, called insectivorous bats. They are smaller than fruit bats, and have a special adaptation to catch insects while flying: they 'see' through sound! Their calls are ultrasonic — a range and pitch of sound that human ears cannot hear. These ultrasonic calls bounce off buildings, trees and insects as echoes, allowing bats to form a mental image of what is around it.

Indian pipistrelles are small insectivorous bats, just a little larger than a butterfly. In the evenings, you will see them zipping past, sideways, forward, up and down, while they look for insects like moths and mosquitoes.

Insectivorous bats are as important to our ecosystems as the fruit bats. Since they eat so many insects including those that destroy our crops, they provide us with free pest control services!

Where can you find them? In the evening or night, you can see them flying in open spaces between buildings or trees, or feasting on insects below street lights. During the day, they roost in cracks in buildings, tree hollows, temples and caves.



Asian Common Toad
The Warty Amphibian



After a rainy monsoon evening, if you step outside and look near the edges of roads or near wet grassy patches, you're likely to spot a warty amphibian that looks a bit like a frog, but not quite. Amphibians are animals that can live on land or in water, as they can breathe in oxygen through their lungs and their skin. This round, bumpy-skinned creature that hops about in the shadows is called the Asian common toad. They prefer environments that have moisture in the air, and so they're particularly fond of living near pools of water — from lakeside paths to little puddles on concrete roads.

Toads are different from frogs. Their skin is rough, they have short and stubby legs, their bodies are stout and they're often found sitting on dry surfaces rather than in water. Frogs, on the other hand, are more slender with moist skins and long limbs. But it's not just the adults that you can tell apart! If you find a sticky clump of eggs near water, they probably belong to a frog, but if it's a long string of eggs, you can be sure that a toad has laid them.

Common toads are masters of finding hollow hiding spots to sit in at night, like sewage drains, bamboo poles or holes in building walls. These resonant chambers amplify the toads' croaks, allowing them to attract mates that may be far away — a neat trick to find each other, especially in a bustling city!

KEY

1,2: Although there is a lot of colour variation in Asian common toads, parts of the male sometimes turn yellow (1) during the breeding season

3: The skittering frog can often be seen floating in puddles and small water bodies with their face above the water



Always be looking!

Whether we realise it or not, we are constantly observing and taking in the world around us through sight, sound, smell and more. Yet, we filter out some of the most fascinating happenings unfolding in our environments — in our homes, walking down a city road, or in a neighborhood park. Tuning into the tales of the natural world can open up our minds to how much natural life we are constantly surrounded by. Cities are often considered to be devoid of nature — a land that has been created by and belongs to people alone. However, as you've seen through our journey together in the Living Museum, it is bustling with fascinating creatures and their various interactions.

There are many ways to look for the characters in our Living Museum. You could **see** birds flying overhead or nesting in a nook, a stream of ants scaling a garden wall, a toad hopping along a pavement, a skink scoting into a pile of leaves, or a wasp building a nest. But why stop at all that your eyes can find? You could **hear** the scratchy screech of a barn owl at night, nesting munias chittering in a grassy plot or the electric buzz of a carpenter bee flying by. You could **touch** the rugged bark of a tree, feel the fragility of an outgrown snakeskin, or the silkiness of a flower petal. You could even **smell** the night-blooming jasmine or the musty guano from your neighbourhood bat colony. All your senses put together can point you in the direction of the teeming biodiversity that lives right by your side!



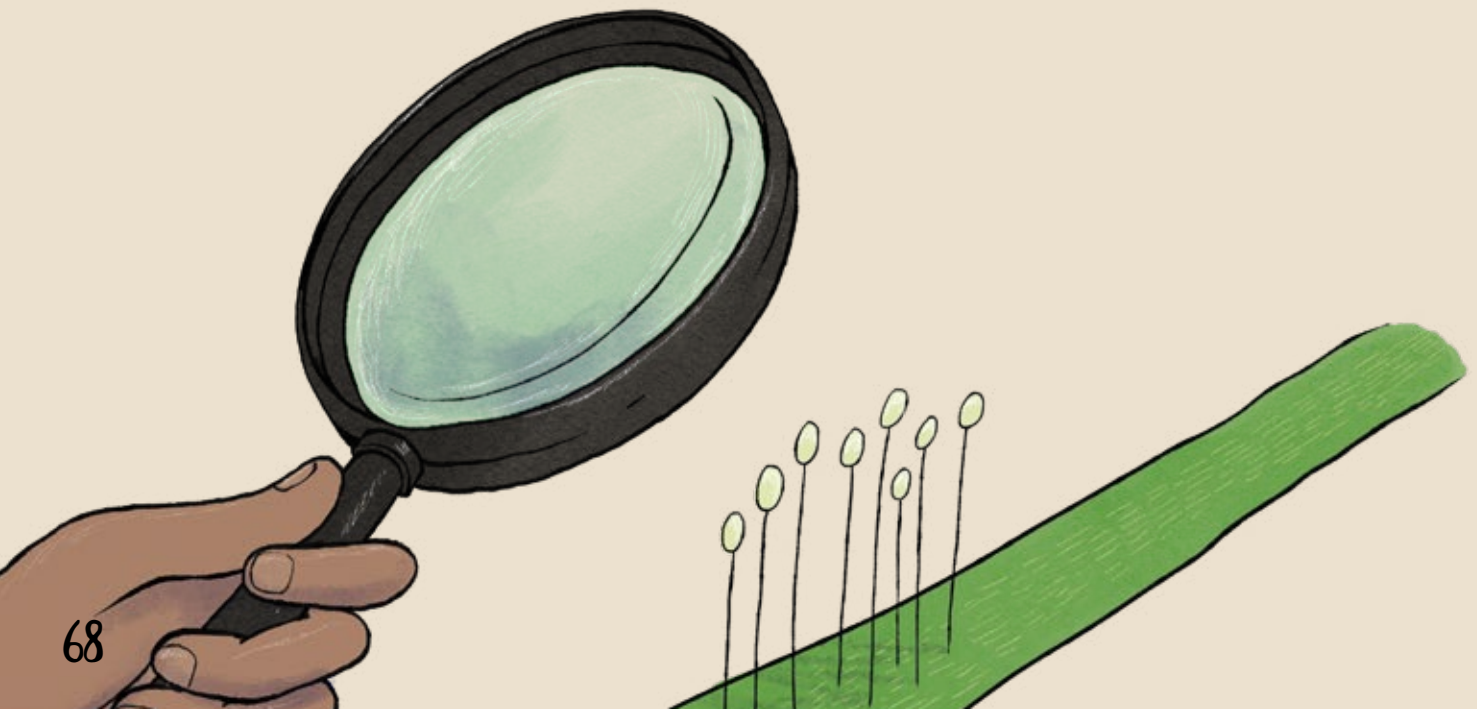
So, how do you keep vigilant and be constantly in search of these creatures? There isn't a single right way to keep your eyes and ears open — the trick is to practice, try out different ways of observing nature, and find what works best for you. Spend a few moments of quiet in your balcony or garden, where you might come across a curious insect or a web-weaving spider. Go out on little walks and observe what's around you. Look under leaves, peer into the cracks of a wall. Take photographs of interesting sights around you — an exoskeleton of an insect, an intricate web, a bird's nest. Describe all that you come across in a diary, using your own words or drawings, even if you don't know what it is you've found. Wonder out loud about what you find, make connections to what you observed before. And keep at it. The Living Museum is forever waiting to be explored.





Once you start tuning in, don't stop at identifying the species you find. Stick around a little longer and you will be treated to fascinating interactions and behaviours that unfold every day around you. Did you find a clutch of tiny eggs on a wall? Keep checking on it to find out what emerges! Try to find where a lizard takes its prey and track the stages of a caterpillar. Notice the plant or tree that a butterfly or bird is sitting on. More often than not, as you watch these events unfold, you will be treated to various other characters from the diverse cast of the Living Museum.

Why should you spend all this time with nature, though? Humans have been observing and learning from nature for millennia. We are, after all, a part of nature — but we seem to have forgotten this along the way. We are now more disconnected from the natural world than we have ever been before. The first step to reignite our lost connections with nature is to notice, find awe in, and make space for nature around us.





Taking in bits of the natural world around you — through observation, writing, photography or art — could teach you more about the natural world than any textbook can. You could be a nature sleuth in the making, uncovering the dramatic lives of the ecosystem that you are a part of. Observing nature has also been scientifically shown to help increase concentration, reduce stress and contribute to your overall well-being. So perhaps the question should be: why shouldn't you spend time with nature?

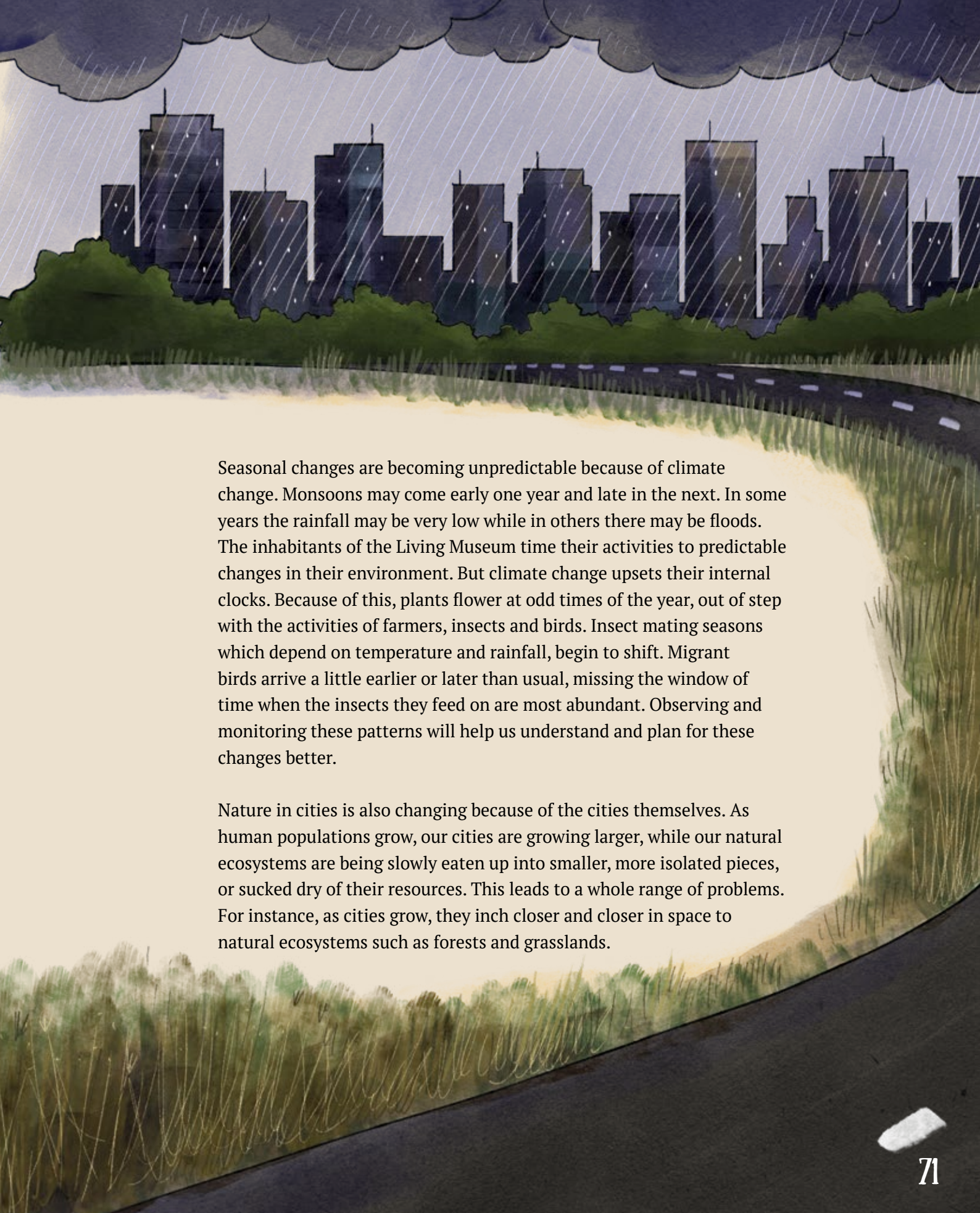
It's good practice to note down the date, time and location for the observations you make — these could come in handy while researching what it is you found, or even for citizen science! And remember — always be a respectful observer.



A large, detailed illustration of a tree trunk on the left side of the page. The tree's branches spread across the top, with several brown and yellow leaves falling from them. The background is a light, warm tone. In the bottom right corner, there is a small illustration of green grass or reeds. The overall style is that of a children's book or a nature-themed magazine.

The Ever-changing Living Museum

Change is a constant in nature. Change blows in with the monsoon winds and on the wings of migrating birds. You can see it in the glimmer of termite wings after a rain. You can hear the crickets singing about it every evening as day changes to night. You can witness the continuous change that trees and plants experience as they cover our roads with their fallen leaves, attract pollinators to their flowers, and burst into fruit. You can observe these changes all around you in the Living Museum, alongside the other haphazard changes of our busy cities.



Seasonal changes are becoming unpredictable because of climate change. Monsoons may come early one year and late in the next. In some years the rainfall may be very low while in others there may be floods. The inhabitants of the Living Museum time their activities to predictable changes in their environment. But climate change upsets their internal clocks. Because of this, plants flower at odd times of the year, out of step with the activities of farmers, insects and birds. Insect mating seasons which depend on temperature and rainfall, begin to shift. Migrant birds arrive a little earlier or later than usual, missing the window of time when the insects they feed on are most abundant. Observing and monitoring these patterns will help us understand and plan for these changes better.

Nature in cities is also changing because of the cities themselves. As human populations grow, our cities are growing larger, while our natural ecosystems are being slowly eaten up into smaller, more isolated pieces, or sucked dry of their resources. This leads to a whole range of problems. For instance, as cities grow, they inch closer and closer in space to natural ecosystems such as forests and grasslands.



Because of this, we are coming into more direct contact with wildlife.

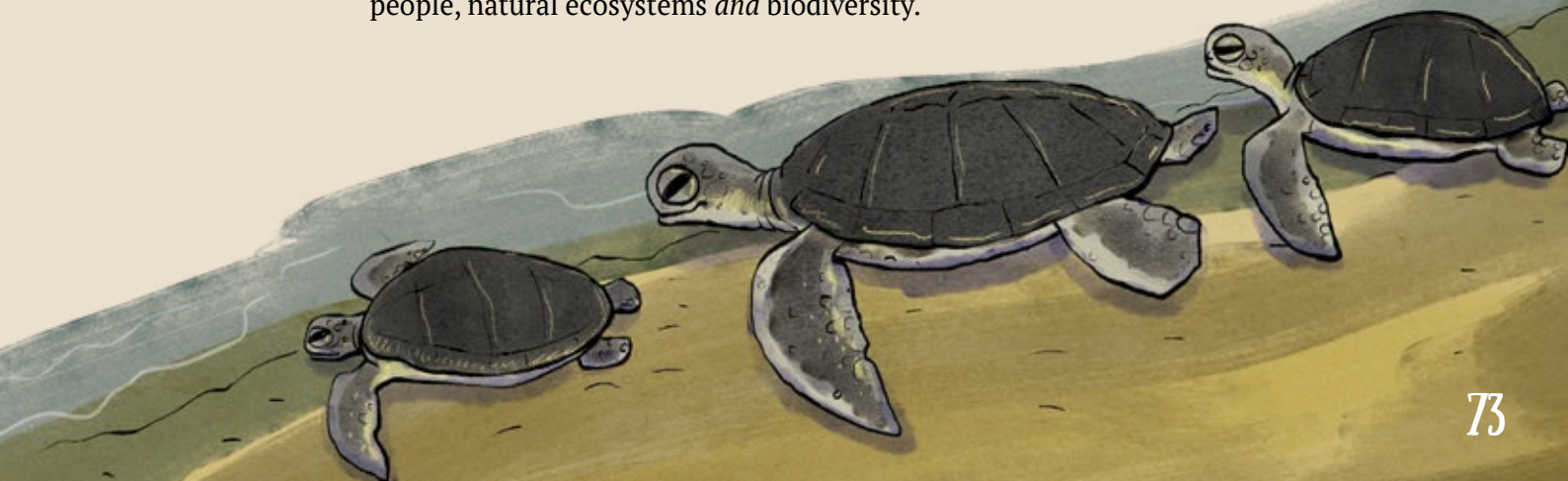
Sharing space with animals, when not dealt with carefully and scientifically, can lead to dangerous situations for both humans and animals. For example, elephants venture very close to Bengaluru, crossing busy eight-laned highways and feeding in the crop fields surrounding the city. Leopards live in college campuses and small forest patches in Mumbai, sometimes getting recorded on CCTV footage in apartment complexes and malls. Helped by scientific studies, people in Mumbai are able to share space with leopards in ways that do not endanger either of their lives. But as Bengaluru is showing us, the expansion of the city cannot be considered separately from the natural ecosystems surrounding it. Unplanned development is only increasing conflict with elephants and other wild animals.

Not all animals are as adaptable as elephants and leopards. Honey bees have lower chances of surviving in parts of the city that have high air pollution. Slender lorises (called *kaadu paapa*, baby of the forest, in Kannada), a small nocturnal tree-dwelling mammal found in parts of South India, requires an unbroken canopy of branches to move. With trees disappearing in cities like Bengaluru, the population of this small



little mammal is quickly declining too, and is currently found only in small pockets of the city.

Cities cannot remain healthy without nature. In fact, healthy natural ecosystems can help cities become stronger in the face of climate change, pollution and water shortage. Trees and parks support biodiversity and improve our mental health, as we have found during the COVID-19 pandemic. Trees also act as air-conditioners and purifiers in our cities, reducing temperatures and pollution. Lakes provide water in drought-like seasons and prevent flooding during the monsoons. Mangrove and intertidal ecosystems protect coastal cities from flooding and coastal erosion. We can gear up for the unpredictable and extreme changes that our future will bring, by planning for cities that support people, natural ecosystems *and* biodiversity.



Understanding The Living Museum

To understand nature in the city, we need to answer questions that ask where, why, how, when, what: Where are different species located? Why are some species declining in number? How does pollution affect species and ecosystems? You do not need to be a scientist to help answer these questions. Citizen science allows volunteers from any background and age group to gather data to help understand the ever-changing Living Museum. Here are four citizen science platforms you can contribute to.



eBird

Citizens across the world can help monitor bird populations by contributing observations to eBird (eBird.org).

Two decades of observations uploaded by citizen scientists on eBird helped scientists in India release a report on the status of India's birds on 2020. According to the report, 80% of bird species in India have declined in the last five years. The report identified 101 species that require immediate conservation attention.

If you are new to birdwatching, there are many free resources to help with bird identification, like the eBird website, and the Merlin or BirdNet mobile applications.

eBird was founded by the Cornell Lab of Ornithology in the USA. The State of India's Birds report was the joint effort of ten organizations in India.



iNaturalist

If you are curious about the identity of the insect that has taken up residence in your house, or the mysterious plant that turned up in your pot, iNaturalist, an initiative to map global biodiversity, can help you. All you need to do is upload a photograph to the iNaturalist mobile application, and the iNaturalist community, or the app itself, will help identify it. Observers have documented more than 100,000 species across the world on iNaturalist. A few of these observations even led to the discovery of species that were new to science. The primary reason iNaturalist was started was not, however, for rare discoveries or to help scientists, but to connect people with nature.

iNaturalist was started by the California Academy of Sciences and the National Geographic Society in the USA.



Mira

Lakes in cities serve many important functions such as holding excess water from rains and recharging groundwater. Lakes and wetlands support birds, fish, and people who use the lake and its surroundings to fish, forage for weeds, and graze. Most of Bengaluru's lakes have been lost to construction, or are polluted from industries.

Mira is a citizen science initiative that trains Bengaluru's citizens to monitor the health of its lakes using low-cost kits. The kits help to record basic indicators of the health of a lake, such as its dissolved oxygen. This information can be uploaded via an app, to a database that can be accessed by anyone (birlakesdashboard.org). You can register for free to receive a kit and a training manual. Mira is currently being used to monitor Jakkur, Rachenahalli, Kaikondanahalli, and Kasavanahalli lakes in Bengaluru.

Mira was founded by the Ashoka Trust for Research in Ecology and the Environment (ATREE), BIOME Environmental Solutions, the Foundation for Environmental Monitoring (FFEM) and NextDrop.



Season Watch

Season after season, the trees around us undergo big transformations. Summers are the season of the mango. Around April is when the Indian Laburnum tree flowers in Kerala, in time for the festival of Vishu. But as our climate and environment changes, so do the seasonal patterns of trees. By observing trees closely over time, we can understand how the climate is changing in different places. This is the simple idea behind SeasonWatch (seasonwatch.in). Through SeasonWatch, you can upload observations of trees around you from anywhere in India, and become familiar with its seasonal patterns over time. Scientists can then study these patterns to understand how the life cycles of trees are changing with climate, and identify trees that are unable to adapt to climate change. Over a thousand schools and individuals across India contribute observations of trees in India to SeasonWatch.

SeasonWatch is a partnership between Nature Conservation Foundation, Wipro Foundation and National Centre for Biological Sciences in Bengaluru.

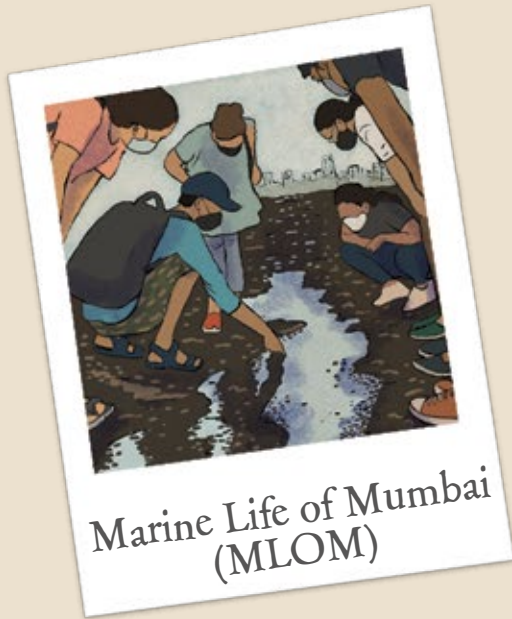


Working for The Living Museum

Our lives are closely tied to nature, both within the city and outside it. Because of this, there are countless ways to engage with, and professionally work in fields that link nature, people and cities. Let's meet a few people and a citizen group, who work for to the Living Museum.

Karthikeyan's interest in nature was sparked when his school science teacher encouraged his class to look for birds in their spare time. That spark has stayed with him ever since. He is now the Chief Naturalist at the Jungle Lodge Resorts in Karnataka, where he trains naturalists. As part of his work, he conducts the popular Naturalist Training Programme — a three-day workshop where he kindles a long-lasting flame of love for natural history and observation skills in a cohort of nature enthusiasts. He has an uncanny way of awakening an interest for everything in nature from insects to birds and mammals. His blog, wildwanderer.com and his pocket guides, *Discover Avenue Trees* and *Explore Spiders of India* are treasure troves of information on urban biodiversity. Through his writing, you might find yourself gently persuaded to observe your natural surroundings a little closer.





Marine Life of Mumbai
(MLOM)

The cast of characters of the Living Museum vary depending on where you are. Coastal cities like Mumbai have ecosystems such as mangroves and sandy or rocky beaches, where marine life is dependent on conditions created by the tide. Sharing precious real estate with busy Mumbaikars are corals, jellyfish, and sea anemones. MLOM was started by a few marine life enthusiasts, to introduce people to Mumbai's marine residents. The group organizes shore and intertidal walks during a small window of time every month when the tide is low enough to see marine life. During these walks, you will see people crouched down, peering at rocks or into tide pools, and gasping in awe at the unexpected exposed marine life they encounter. The walks have led to the observations of more than 460 marine species recorded on iNaturalist. MLOM led to the formation of the Coastal Conservation Foundation, an NGO which aims to take MLOM's work to other coastal cities.



Harini Nagendra wants to understand, and allow us to imagine, how cities can grow with, and because of nature and not at the cost of nature. For her book, *Nature in the City: Bengaluru in the Past, Present and Future*, Harini and her colleagues traveled back in time through historical artifacts and archives in libraries, to understand Bengaluru's past. She found that the people of the city's past fostered close ties with nature. Connected lakes and planted trees helped nurture a flourishing city. This connection was lost in the recent decades. Droughts and floods are now more common with the loss of lakes, and the city is becoming hotter due to the loss of trees and increased paved surfaces. Harini believes that lessons from the past can help us plan cities in sustainable ways that benefit everyone. Harini teaches ecology and sustainability for Master's and Undergraduate students in Azim Premji University in Bengaluru. She is the co-author of *Cities and Canopies: The Tree Book of Indian Cities*, and writes a monthly column in the *Deccan Herald* called *The Green Goblin*.

When Vena first learned about the fig wasp, she was indignant that she had not learned about it in school. She saw a need to reshape Environmental Studies (EVS) curricula in schools to reflect commonly found biodiversity like the fig wasp. Vena, along with school teachers, and colleagues at the Bengaluru-based Nature Conservation Foundation, co-creates nature learning resources that are suited to different age groups and tailored to local learning environments and cultures in India. These learning resources include attendance registers for birds, and games that nudge students to look for 'hidden housemates' like geckos and birds. If nature were a religion, and Vena its priest, her trademark sermon is about spiders. Through talks, stories, and nature walks, she captivates people with fascinating details about the hunting and mating behaviour of spiders. She is usually found with a hand lens, and a smile, peering at any insect that catches her eye on a wall, road, or plant around her.





We would like to thank you!

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If you live in a city, you have a free, life-long ticket to the Living Museum. Visit whenever you want, stay as long as you like. You will be treated to living exhibits whose lives unfold around you, sometimes predictably, and sometimes unexpectedly. During morning shows, you might catch the dazzling purple sunbird drinking nectar from a milkweed flower while a carpenter bee drones away. During the night shows, you are sure to see flying foxes flying high in the sky to their feeding grounds. Whenever you do visit, you're sure to leave with a smile, your senses a little sharper, your curiosity awoken.

This book is a short guided tour to the Living Museum, led by a jumping spider. She hopes it will inspire you to tune in to nature around you, everyday. Come along now, we mustn't waste a moment, or we might miss something exciting!

